IMPROVED VISIBILITY
WITHIN
THE AIR FORCE ITV SYSTEM

GRADUATE RESEARCH PROJECT

Dean A. Wolford, Major (Sel), USAF

AFIT/GMO/LAL/96N-15

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/GMO/LAL/96N-15

IMPROVED VISIBILITY
WITHIN
THE AIR FORCE ITV SYSTEM

GRADUATE RESEARCH PROJECT

Dean A. Wolford, Major (Sel), USAF

AFIT/GMO/LAL/96N-15

AFIT/GMO/LAL/96N-15

IMPROVED VISIBILITY

WITHIN

THE AIR FORCE ITV SYSTEM

GRADUATE RESEARCH PROJECT

Presented to the Faculty of the Graduate School of

Logistics and Acquisition Management of the

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the

Requirements for the Degree of

Masters of Air Mobility

Dean A. Wolford, B.S., M.A.

Major (Sel), USAF

November 1996

Approved for public release, distribution unlimited

Acknowledgments

This research project would not have been possible without the help of many fine individuals. I want to thank the following for their time, support, and exceptional efforts in the research and review of this project: Lt Col James Wakeley, HQ USAF; Lt Col Robert Ross, USTRANSCOM J4-LTF, Ms. Trish Young, USTRANSCOM J4-LTF; Ms. Sharon Boynton, USTRANSCOM J4-LTF; Mr. Michael McVeigh, Emery Worldwide; and Mr. Bob Jones, United Parcel Service. By answering numerous questions during their interviews, they provided the support and foundation of this project.

I am grateful for the assistance of my AFIT research advisor, Major William Scott. Without his assistance this paper would not have been possible; I owe him a great debt. A big thanks also goes out to the unwavering dedication of Dr. Craig Brandt, Lt Col Jacob Simons, and Lt Col (sel) Terry Pohlen who were the key to the overall success of the Advanced Study of Air Mobility (ASAM) program. Their tireless work is greatly appreciated.

Finally, I would like to thank my wife, Kathy, our son Bryan, and daughter Brittany for putting up with me during this 14 month long ASAM program. My wife and children will continue to be my pillars of support. They have yet to receive a medal, ribbon, or citation for their sacrifices. They prefer to stand quietly behind me with a smile and encouragement knowing their medal is in my heart.

Dean A. Wolford

Table of Contents

Page

Page

List of Figures

List of Tables

Abstract

Computers, information systems, and communication systems are being used in transportation, warehousing, order processing, materials management, and procurement. In every major US deployment, lack of visibility over units and shipments entering a theater of operation has limited the military's ability to effectively conduct operational plans. Current Department of Defense (DoD) initiatives provide some level of in-transit visibility (ITV), but are we effectively using quality tools to benchmark the successes within the commercial carrier industry? The purpose of this study is to address the ITV issues and concerns existing in the military and civil intermodal shippers. Projected benefits from this study will highlight the operating ideas that are needed to support a standardized DoD communications network system that works in harmony with its civilian counterpart.

This analysis concludes that the Global Transportation Network (GTN), augmented with electronic data interchange (EDI) and automatic identification technology (AIT), provides an avenue for quality information to be provided to the Defense Transportation System (DTS) users. However, data structure and processing, need to be standardized within DoD trading partners. Attention also needs to focus on initial data input error rates. Automatic technology is worthless if the wrong data is fed to the computer.

IMPROVED VISIBILITY

WITHIN

THE AIR FORCE ITV SYSTEM

I. Overview

Introduction

As the post cold war world has evolved, it has become apparent that the "hot spots," those places where the DoD can expect to deploy US military force -- from Somalia to Haiti -- are generally austere environments, essentially lacking the robust automation and communications infrastructures the DoD has grown to rely upon to conduct our daily business. The devastating impact of the inability to pass information to or retrieve information from these theaters can be seen in the logistics after action reports about the Gulf War. During Desert Shield/Storm, the Department of Defense (DoD) was plagued by a lack of visibility over shipments entering the theater. Over 20,000 of the 40,000 containers entering the theater had to be opened, inventoried, sealed, and reinserted into the transportation system because their contents were not known (DoD, 1995a: 1-1). Consequently, the endless multiple requisitions for the same part, the backlogs and bottlenecks at ports, roadways, and forward facilities tied up large quantities of government funds in useless or unproductive requisitions.

The military can no longer expect to win wars through the application of "brute force logistics." The demands of regional conflicts, humanitarian support, and other nontraditional DoD missions dictate the need for a flexible logistics system capable of efficiently and effectively supporting our soldiers, sailors, airmen, and marines -- rapidly and with no waste -- anywhere in the world (McHugh, 1994) The DoD can no longer afford to stop the flow of logistics to assess what we have on hand and what is flowing in the logistics pipeline. Information about what you have, what is coming, and where it is must be readily available to decision makers at all levels -- from the soldier at a regional supply center to the regional Commander-in-Chief (CINC) to the National Command Authority (NCA). Global competition has forced businesses to recognize that "time is the enemy." Lessons learned from the Gulf War caused the DoD to recognize the same overriding concept.

As technology improves and becomes cheaper, businesses are faced with the alternatives of keeping up with technological innovations or else go out of business. Consequently, many organizations are beginning to form co-operative ventures with competitors, suppliers and customers (Swatman, 1995: 1-6). It becomes increasingly clear that as the DoD continues to use the commercial marketplace to meet our transportation needs, it must look toward building strategic alliances within the commercial transportation community.

Background

Effective transportation and accurate logistics data are essential elements to our national security. Air Force Doctrine Document (AFDD) 40 explains that there are seven logistical concepts that provide direction for Air Force leaders to create and sustain military projection and power. These concepts are pipeline security; total asset visibility;

training, education, and exercises; interoperability; availability; transition to and from war; and host nation support. These concepts are not applicable to every military activity, but they do have a significant value during these times of military funding cutbacks and our increased reliance on commercial carriers to aid in transporting DoD cargo (AFDD 40: 18-32). As our global transportation needs change, we must work to build a partnership with the commercial transportation industry.

In today's environment of high-tech warfare, operational commanders must be able to maintain equipment at the highest possible state of readiness. The consequences associated with lost or delayed material are too great to rely on inaccurate or slow information. The Defense Transportation Systems (DTS) does not share this burden alone. The commercial air, sea, and land transportation accounts for a significant percentage of DoD cargo movement each year. It was estimated that during Desert Shield/Storm, 36% of all resupply shipments were commercial air direct vendor deliveries (NDTA: 5-14). Military Traffic Management Command (MTMC) moves 100,000 container loads per year; 25% of these moves are attributed to commercial vendors. Army/Air Force Exchange Service (AAFES) claims to move 30,000 container loads per year; 50% are carried by commercial vendors. Adding to these numbers, Defense Logistics Agency (DLA) moves over 1.9 million shipments per year; 60% are identified as vendor direct delivery shipments. Its obvious, the DTS relies heavily on our commercial transportation community to move vast quantities of cargo (NDTA: 5-14). As the DoD grows more dependent on its commercial carriers, it must be willing to absorb the commercial transportation experience, such as electronic data interchange (EDI) and automatic identification technology (AIT), and apply them to the DoD in-transit visibility (ITV) initiative.

United States Transportation Command (USTRANSCOM) defines in-transit visibility as

> the ability to track the identity, status, and location of DoD unit and non-unit cargo (excluding bulk petroleum, oil, and lubricants) and passengers; medical patients; and personal property from origin to consignee or destination during peace, contingencies, and war. However, it constitutes only a portion of the requirements for Total Asset Visibility (TAV), which also includes the tracking of in-process assets (being procured or repaired) and in-storage assets (inventory at Defense storage locations). (DoD, 1995a: iii)

Emery Worldwide and United Parcel Service (UPS) also share USTRANSCOM's concerns for tracking, identifying, and locating cargo. Emery Worldwide is a $1.8 billion company specializing in business-to-business air and ocean freight, logistics service and customs brokerage (McVeigh, 1996). Emery offers an array of expedited and time-defined delivery options for any size freight shipment. With consistent on-time delivery, Emery moves 7 million shipments per year, totaling 773,000 tons. Information has become as much a part of Emery's services as the transportation of freight itself. Emery's global information system, EMery CONtrol (EMCON), provides administrative communications between Emery offices and customers, shipment tracking information, price quotes and operational reports to ensure the integrity of freight movement.

The competitive arena within the express carrier business has stretched to global proportions. In 1994, express carrier shipments totaled $1.1 billion, and exported packages from the United States exceeded 61 million in number (Coleman, 1995: 26-27).

Technology has become the key basis of differentiation among carrier services (Maglitta, 1994: 15). In 1985, UPS's information systems group consisted of only 118 employees with a budget of $40 million. Today UPS's information staff totals 4,000 and hopes to acquire market dominance with a 10 year, $3 billion technology development plan, aimed at strengthening electronic links with over 1.2 million customers.

In 1985, UPS's annual sales were estimated to be $7.6 billion; by 1995, sales increased to $19.4 billion. Annual income also increased from $568 million to $900 million. Through the use of technology, UPS has gone global. It now delivers 3 billion packages a year to over 200 countries. UPS officials will invest $100 million annually for the next few years on customer automation (Maglitta, 1994: 15). "It's no longer an issue of overnight, but rather what time of day," notes Perter Fredo, vice president in charge of advertising at UPS (Coleman, 1995: 26-27).

Description of the Problem

Keeping track of assets and personnel in the DTS has challenged the DoD for many years. Yet, UPS and Emery Worldwide have been demonstrating that capability for some time now. Both UPS and Emery Worldwide claim to be able to provide their customers with information about shipments 24 hours a day, 7 days a week, 365 days a year. Analyzing some of the different methods of capturing transportation information is the emphasis of this research.

DoD ITV Plan

Shortcomings in military logistics operations will continue to exist until the DoD implements a comprehensive ITV plan. As an outgrowth of this problem, in 1994, USTRANSCOM embarked on an aggressive program of ITV study and development. Their efforts were aimed at focusing energy, attention, and resources toward obtaining an ITV capability for the DoD (DoD, 1995a: 3).

USTRANSCOM's efforts proved beneficial. They developed an ITV plan that is functionally designed to be a living document. This document will be supplemented with more detailed action plans as needed to remove impediments to timely and efficient information exchange between transportation, operations, and command and control nodes.

Total asset visibility (TAV) includes the tracking of in-process assets (being procured or repaired) and in-storage assets (inventory at Defense storage locations) (DoD, 1995a: 1-1). The DoD defines TAV as "the capability of both operational and logistics managers to determine and to act on timely and accurate information about the location, quantity, condition, movement, and status of DoD materiel assets" (TAV Conference, 1994). As Figure 1 suggests, ITV is a component of TAV complemented by EDI and AIT. USTRANSCOM's plan remains consistent with the DoD's TAV objectives of improving logistics support to the customer. The Global Transportation Network (GTN), state-of-the-art technologies, and process improvement each contribute to the DoD's functional ITV plan.

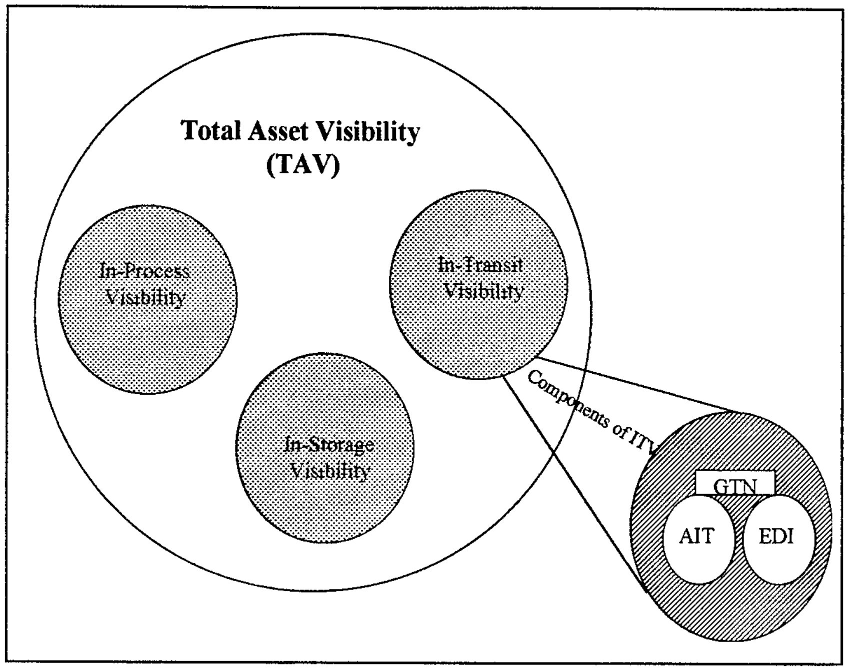

Figure 1. Pillars of TAV

So, where does the DoD's ITV plan begin and what makes up its components? USTRANSCOM's ITV responsibility begins at origin and ends with receipt at consignee or destination designated by the CINCs, Military Services, or Defense agencies. DoD's ITV plan divides ITV into two major components: cargo and personnel. The plan further divides cargo into: unit, non-unit, personal property, and redeployment and retrograde components. Personnel is broken down into unit, non-unit, medical patients, and redeployment components (DoD, 1995a: 3-1). A visual depiction of these subcomponents is illustrated in Table 1.

Table 1. DoD's ITV Operating Concept (DoD, 1995a: 3-1)

Cargo:	Personnel:
Unit	Unit
Non-Unit	Non-Unit
Personal Property	Medical Patients
Redeployment & Retrograde	Redeployment

Cargo - Unit Moves. "includes all unit equipment, accompanying supplies, Marine Corps Maritime Prepositioned Forces, Army unit equipment aboard prepositioned afloat ships, and prepositioning of Materiel Configured to Unit Sets (POMCUS) stocks." (DoD, 1995a: 3-1).

Cargo - Non-Unit Moves. "includes all sustainment material (except the supplies and equipment accompanying a unit during deployment) in CONUS, pre-positioned overseas, or afloat." (DoD, 1995a: 3-8).

Cargo - Personal Property. "includes household goods, unaccompanied baggage, privately owned vehicles, mobile homes belonging to military members and civilians employees of the DoD and U.S. Coast Guard." (DoD, 1995a: 3-22).

Cargo - Redeployment & Retrograde. "the DoD refers to material leaving a theater location bound for another theater as redeployment cargo and material bound for CONUS as retrograde cargo." (DoD, 1995a: 3-25).

Personnel - Unit. "include all civilian and military passengers directly attached to a deploying unit. Passenger's name, social security number, service specialty code, unit line number (ULN), ultimate destination, and intransit location must be readily accessible." (DoD, 1995a: 3-26).

Personnel - Non-Unit. "include temporary duty, permanent change-of-station personnel, medical attendants, and replacement personnel moving through the military and commercial transportation system." (DoD, 1995a: 3-31).

Personnel - Medical Patients. "includes all essential patient data, along with selected transportation data as medical patients move from treatment facilities." (DoD, 1995a: 3-35).

Personnel - Retrograde. "include entire units and individual non-unit personnel that are periodically reallocated, reassigned, or relocated to other areas of operation within theater, to another theater, or back to CONUS." (DoD, 1995a: 3-39).

The complexities of developing a worldwide ITV capability, mandate that the DoD implement its ITV plan in a logical manner. However, the multitude of tasks, and urgent need for ITV for each of these functional areas makes implementing USTRANSCOM's ITV plan a complex yet, necessary assignment.

Investigative Questions

The following questions form the investigative basis of this research paper:

1. The DoD has several requirements for an ITV system. USTRANSCOM has made considerable progress in laying the foundation, through GTN, for a DoD-wide ITV capability. What are some key developments that contribute to a responsive GTN system?

2. In the past, poor data quality and the absence of timely data, each contributed adversely to an inadequate ITV system. Effective ITV is possible only if the defense and commercial systems that feed GTN provide timely and complete data with a high degree of accuracy. How can the DoD increase its efficiency of its transportation system using electronic technology?

3. Even after GTN is developed and the required system interfaces are in place, the risk of inadequate communications capacities in many potential theaters throughout the world will still be high. What is the DoD exploring to augment its current data collection efforts?

4. Implications associated with transportation standards and fragmented regulations within the DoD transportation system are being addressed. What are some of the initiatives USTRANSCOM is taking to overcome these implications?

Methodology

An analysis of in-transit visibility was conducted while defining the role and characteristics of the GTN. Also, the existing commercial tools used to track cargo was reviewed, weaknesses and deficiencies discussed, and the need for data standardization examined.

Understanding the problems affecting ITV initiatives between the DoD and the commercial carrier requires a unique vocabulary. A short description of some of the computer systems which are used for processing transportation information can be found in Appendix A. Appendix B provides additional information with a list of common acronyms. Appendix C contains the operator error metrics used in the human interface discussion. The reader is encouraged to reference these appendices often while reading through these pages.

The commercial applications available to the DoD and its quest to capture in-transit visibility will be the primary focus of Chapter II. It will summarize some of the technical initiatives that are making their way into the transportation industry. Chapter III highlights and attempts to expand on some of the implications introduced in these first two chapters with Chapter IV proposing possible consequences to solutions or alternatives.

Summary

There are a number of key issues that must be addressed before full ITV implementation can be a success. As the DoD continues to reduce its force structure, it will be forced to rely more and more on the commercial carriers to fulfill their transportation needs. The benefits derived from improved ITV are both operational and financial. Operationally speaking, improved ITV will result in better support for the theater CINC. USTRANSCOM's GTN, augmented with EDI and AIT, will help improve the transportation process by allowing theater logisticians to quickly determine which material may have reached its geographic area and which items have not. Financially, ITV will reduce or possibly eliminate duplicate ordering as work to speed up the transportation pipeline by effectively routing supplies.

II. Emerging Information Technology

Overview

The decline in the defense budget over the last ten years and changes in our military strategy from forward presence to force projection require logisticians to seek cost saving alternatives to improve the efficiency of overall operations. This chapter presents a brief glimpse at the issues that led to the evolution of USTRANSCOM's core network for ITV, the Global Transportation Network (GTN). Some of the emerging commercial practices available to Air Force logisticians will be examined. The chapter concludes with the need for data standardization.

Establishing the Need for In-transit Visibility (ITV)

The need for in-transit visibility is not a new problem. Lack of visibility over equipment entering a theater has limited operations in every major deployment during the 20th century. "AMC is a major player in every on-going military operation in the world today" (Fogleman, 1994a). Meanwhile, the operating tempo of strategic airlift forces has steadily increased since Operation JUST CAUSE in December 1989, and no relief is in sight for these limited, yet crucial resources (Bossert, 1995: 2).

In the post cold war era, DESERT STORM demonstrated AMC's airlift importance, yet it also highlighted DoD's dependence on commercial transportation. During the course of the operation, approximately 33% of the USAF C-5 fleet was grounded at any one time for maintenance; the C-141 fleet, the cornerstone of strategic airlift, was experiencing structural problems which forced it to be periodically grounded;

and the C-17 was caught up in a economical and political battle of its own (Lund and others, 1993: 54). As DoD cargo moved through various commercial carriers, the DoD had limited visibility on its cargo; they were dependent on carrier specific tracking devices.

In his August 1994 report to Congress concerning the state of defense transportation preparedness, General Ronald R. Fogleman said,

> We must look for ways to improve our effectiveness while reducing the cost. We must build a better defense transportation system -- one that is designed to meet the needs of the combatant commanders at the best value to the American taxpayer. (Fogleman, 1994b: 2)

Emphasizing General Fogleman's concerns, the authors of the 1996 Air Mobility Master Plan (AMMP) have recognized the importance in achieving in-transit visibility as being the single most challenging task of USTRANSCOM and AMC. The capability to monitor the status of cargo is crucial to the mission. AMC must be able to locate each piece of cargo and communicate that information to the customer using minimum manpower and duplication of effort (AMMP, 1996: 4-33).

With the shrinking size of our airlift fleet and the reductions of depot inventories, ITV is a necessity for an effective logistics system (Gross 1995: 2-4). As the Air Force moves toward the 21st century, future military operations will likely involve quick responses to remote locations. Therefore, improved ITV systems will have to rely on fewer people while providing better ITV information in order to meet the continuing challenges and demands of the current military strategy.

Global Transportation Network (GTN) Background

In 1992, Office of the Secretary of Defense (OSD) assigned USTRANSCOM responsibility for developing a DoD-wide ITV system (USTRANSCOM, 1995b: 4). As the DoD ITV functional proponent, USTRANSCOM is responsible for worldwide strategic mobility planning; transportation-related automated data processing systems integration; and centralized traffic management.

Emphasizing the need for efficient and effective use of our transportation system, in 1994, as Commander-in-Chief, USTRANSCOM, General Ronald R. Fogleman stated, “as the US reduces its military presence overseas, managing force movements may be the greatest challenge of all” (Fogleman, 1994a). With fewer assets available and fewer people to manage them, it is essential to know, at all times, the location and availability of personnel, supplies, and equipment for employment or consumption.

At the nucleus of the DoD’s ITV operating concept is USTRANSCOM’s GTN. GTN is a command and control (C^2) information system designed for USTRANSCOM’s mission as global transportation manager. When fully implemented, GTN’s transportation component will be able to track individual requisitions, items, and unit movements; reconstitute shipments; and divert shipments to new destinations (USTRANSCOM, 1995b: 1).

The role of the DoD Corporate Information Management (CIM) effort cannot be overlooked in the development of the GTN. Sound business solutions, through interactive management information programs, are used constantly throughout the commercial world. CIM’s effort is designed to foster process improvements, efficiencies, and increased productivity within selected functional business areas, including transportation. In a memorandum dated October 13, 1994, then Deputy Secretary of Defense William Perry reiterated his support for CIM, and, in fact, called for acceleration implementation of migration systems, data standardization, and process improvements (McHugh, 1994).

Our partnership with the commercial sector is another crucial factor in our drive toward achieving ITV capability. In a discussion concerning commercial air, land, and sea carriers, Assistant Deputy Undersecretary of Defense for Transportation Policy, Ms. Mary Lou McHugh said, "the US military moves 90% of its assets via commercial carriers during peacetime, and 85% via commercial carriers during war" (McHugh, 1994). These statistics alone do not explain the need for DoD and commercial interface. The DoD must build upon the foundation of the work already accomplished by the commercial carriers.

Global Transportation Network (GTN)

It has been said that the role of the GTN is two-fold (Boynton, 1996). First, it is an integrated, automated, command and control information system that focuses on global transportation management. It serves as a central repository of information which can be used to support decision making in a global environment. Secondly, it is designed to "collect, consolidate, and integrate the status and location of military cargo, passengers, patients, and lift assets from multiple DoD and commercial transportation systems."

In 1989, USTRANSCOM demonstrated an ITV "proof-of-concept" GTN prototype. This prototype focused primarily on *pulling* "real-time" ITV information from existing databases. In 1990, Version 1.0 added leased telephone lines and a cache data base to retain query information for 24 hours. Both the prototype and Version 1.0 were considered to be communication-intensive due to their reliance on *pulling* data. To resolve these problems, USTRANSCOM produced Version 2.3 which uses the participating systems to *push* data to a central data base. This approach opened the gateway for a much larger base of customers without significantly tasking the interactive support systems (DoD, 1995a: 1-4).

USTRANSCOM considers GTN to be the heart of ITV (Boynton, 1996). It is expected to provide a standard method of tracking material through the transportation pipeline by linking the many various systems currently used in the other branches of service and participating commercial carriers. Figure 2 depicts the vast amount of information made available to GTN. ITV is achieved by tapping into a wide array of independent systems and consolidating the acquired information into a central database. The systems that interface with GTN are divided into two categories: source data (which push information to GTN) and customer systems (which pull information from GTN).

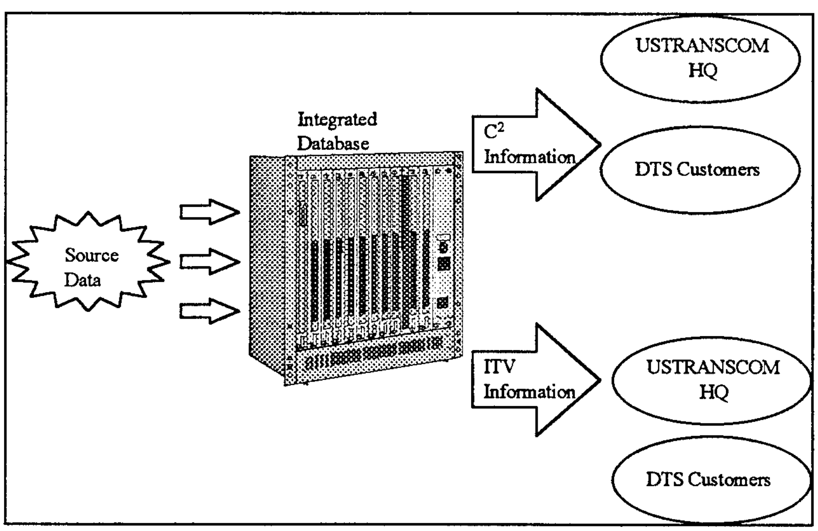

Figure 2. GTN Concept (Boynton, 1996)

GTN will collect data from source systems in an integrated database, and provide ITV and C^2 applications and information to support its customers -- USTRANSCOM and DTS customers. GTN also provides a means to support customers in the areas of current operations, future operations, and medical evacuation (Boynton, 1996).

Currently, Version 2.3 supports USTRANSCOM's mission by receiving C^2, transportation, and logistics data from Air Mobility Command (AMC), Defense Logistics Agency (DLA), and Military Traffic Management Command (MTMC) and then consolidating this data into a single database. Table 2 identifies each of these sources and matches each Transportation Component Command (TCC) to their respective subcomponent. Table 2 also illustrates the various source update transaction times as information flows toward the GTN system.

Table 2. GTN Component Systems Updates (DISA, 1995a: 22)

AMC Systems:	Sends updates to GTN
PRAMS	every four hours
CAPS II	continuously
GDSS	every transaction
HOST	continuously during contingencies
DLA System:	
DAAS	every 15 minutes
MTMC Systems:	
METS II	once a day
TERMS	continuously
WPS	provides info to METS II & TERMS

A description of how this data system might work is explained in the following example (DISA, 1995a: 15). Personnel and/or material normally enter the DTS at an origin. Several transportation systems exchange information with GTN to track transportation requirements and cargo status from Origin to the Aerial Port of Embarkation (APOE). Air passenger reservation and manifesting information is provided by the Passenger Reservation and Manifesting System (PRAMS). The Consolidated Aerial Port Subsystem II (CAPS II) furnishes air cargo manifest and itinerary information. While the Terminal Management System (TERMS), Worldwide Port System (WPS) , and the Mechanized Export Traffic System II (METS II), furnish source data on booking, manifesting, and transportation materiel by ocean carriers.

Once cargo and/or passengers have been manifested, the Global Decision Support System (GDSS) furnishes information to GTN concerning the carrier's progress along the intended itinerary. In a like manner, WPS provides GTN itinerary information on ocean carriers.

When the air carrier arrives at the Aerial Port of Debarkation (APOD), PRAMS and CAPS II exchange data with GTN concerning receipt information on passengers and cargo, respectively. Similarly, TERMS and WPS offer GTN information on the receipt and status of ocean cargo (DISA, 1995a: 15).

The value of this information is considerable. It will significantly improve the ability of logistic/supply personnel to support their respective activities by giving them the capability to track and/or locate material in-transit including requisitions, retrograde, bulk shipments, partial and split shipments, containers, and equipment. They will be able to access manifests, display itineraries for individual Transportation Control Numbers (TCNs), and track material being shipped by non-DoD (commercial) assets. The indirect benefits, such as tracking personnel, also represent significant value. Furthermore, activities displayed on GTN are provided on a need-to-know basis, and access to C^2 information is strictly controlled. A user account, issued by the system administrator at USTRANSCOM, enables the user to access GTN's window displays (DISA, 1995a: 22).

Joint Transportation Corporate Information Center

Since GTN is designed to collect data from existing DoD and commercial systems, who controls the legacy systems that interact with GTN? Under the control of USTRANSCOM, the Joint Transportation Corporate Information Management Center (JTCC) is designed to foster process improvements and improve the efficiency and effectiveness of defense transportation by providing central direction for transportation information system's development and migration. Selection of migration systems will eventually decrease the number of automated systems, thereby streamlining the number of systems generating ITV data. JTCC's goal is to eliminate unnecessary duplication, provide cost effective solutions, and improve processes and capabilities while still meeting DoD unique requirements (DISA, 1995b: 1).

The JTCC, in its migration strategy initiative, has done a great deal of work on identifying current and planned ITV systems. During an interview in 1994, then Commander-in-Chief, USTRANSCOM, General Ronald L. Fogleman spoke about why he asked his staff to identify all DoD funding for ITV initiative, he responded,

> GTN was so dependent on legacy systems [automated data processing systems being phased out or scheduled to be phased out]. If other organizations were developing or planning to develop follow-on systems to these legacy systems that were not open or

> could not exchange information with GTN, we needed to know
> about them and stop or redirect their effort. (Mathews, 1995: 21)

According to the Defense Information Systems Agency (DISA), by 10 May 1994, the JTCC identified 120 different systems which processed transportation information. Consequently, in June and early July of 1994, the JTCC found an additional 17 systems. This brought the total number of information systems to 137. Of these systems, some had their primary function outside of the transportation. By 31 March 1995, in an attempt to reduce this figure, 23 systems were approved for migration. This reduction cause 65 information systems to be eliminated or eventually phased out of service. The remaining systems are still pending action. The surviving 23 migration systems were evaluated on the basis of functional coverage, technical merit, and programmatic requirements (DISA, 1995a: 5). As a result of the JTCC's actions, Table 3 summarizes the nine functional categories, the 23 migration systems, lead agencies, and source funding. Not only does this table identify the migration system by category, it also identifies which the lead agency is responsible for development and implementation. The funding column allows viewers the opportunity to know the funding status. For example, CFM funding is provided by the Defense Business Operations Fund (DBOF) resources. In other words, if output can be measured, costs can be accounted, and customers can be identified, then the DBOF system can be self-perpetuating depended on the sale of "goods" or "services" to pay operational expenses and replenish inventory (D'Angelo, 1996). For a detailed description of the surviving 23 migration systems, see Appendix A.

Table 3. Migration Summary (Whitaker, 1996)

Category	Num	System	Lead Agency	Funding
Unit Move	1	TC-AIMS II (TC-AIMS/MDSS II)	USA	Approved
ITO/TMO		TC-AIMS II (CMOS)	USA	Approved
	2	CFM	MTMC	DBOF
	3	CANTRACS	DLA	Approved
	4	TOPS	MTMC	DBOF/Approved
	5	PRAMS	AMC	DBOF
	6	GOPAX	MTMC	DBOF
Load Planning	7	ALM	MTMC	Approved
	8	ICODES	MTMC	DBOF/Approved
Port Management	9	ITV-MOD (CAPS II)	AMC	DBOF
	10	WPS	MTMC	DBOF/Approved
Financial Mgmt		Pending	USTC	DBOF
Mode Clearance	11	NAOMIS	USN	Approved
	12	IBS	MTMC	DBOF
	13	MOBCON	USA-NG	Approved
Therater Trans Ops		TC-AIMS II	USA	Approved
	14	C2IPS	AMC	DBOF/Approved
	15	DAMMS-R	USA	Approved
Planning/Execution	16	ADANS	AMC	DBOF
	17	GDSS-MLS	AMC	DBOF
		ITV-MOD (HOST)	AMC	DBOF
		C2IPS	AMC	DBOF/Approved
	18	GTN	USTC	DBOF
	19	ELIST	MTMC	DBOF
	20	AMS (MTMC)	MTMC	DBOF
	21	IC3	MSC	DBOF/Approved
Other	22	JALIS	USN	Approved
	23	DTTS	USN	Approved

Information Capture

Electronic Data Interchange (EDI). Electronic data interchange (EDI) is an application of computer technology that is moving both private and public business sectors from a paper-based world to one that is based solely on electronic transactions. Rand National Defense Research Institute defines EDI as "the electronic exchange of formatted business transactions between organization's computers." (Payne and Anderson, 1991: 1).

In May 1988, the Deputy Secretary of Defense issued a policy directive that declared EDI as the "way of doing business" for the DoD. Since several EDI technologies were available, the question of how to implement EDI was the first hurdle for the DoD (Payne and Anderson, 1991: 1). Where should the DoD focus its resources to implement EDI in order to enhance its effectiveness? How must logistics change to take full advantage of EDI?

EDI in the DoD. As shipments move from origin to destination, every activity that handles the cargo requires some level of content information. In an attempt to enhance EDI's effectiveness, USTRANSCOM developed the Defense Transportation EDI (DTEDI) Implementation Plan. This plan explains how eleven transportation processes are affected when implementing EDI in the DoD's transportation system (DoD, 1996a: 3-1). Figure 3 divides these eleven processes into four areas: tender submission, planning, movement, and payment.

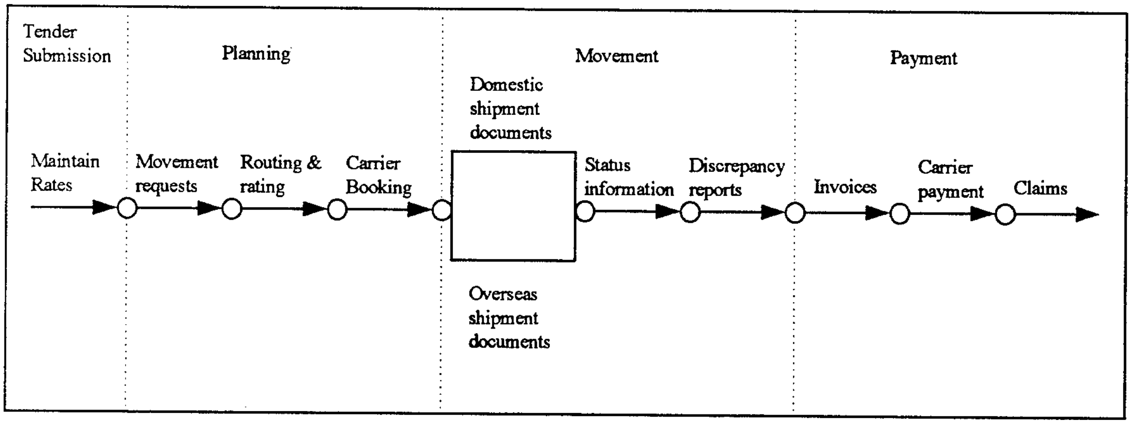

Figure 3. Transportation Processes (DoD, 1996a: 3-1)

Figure 4 demonstrates how the four areas of the transportation EDI process works toward providing ITV from start to finish (DoD, 1996a: 3-6).

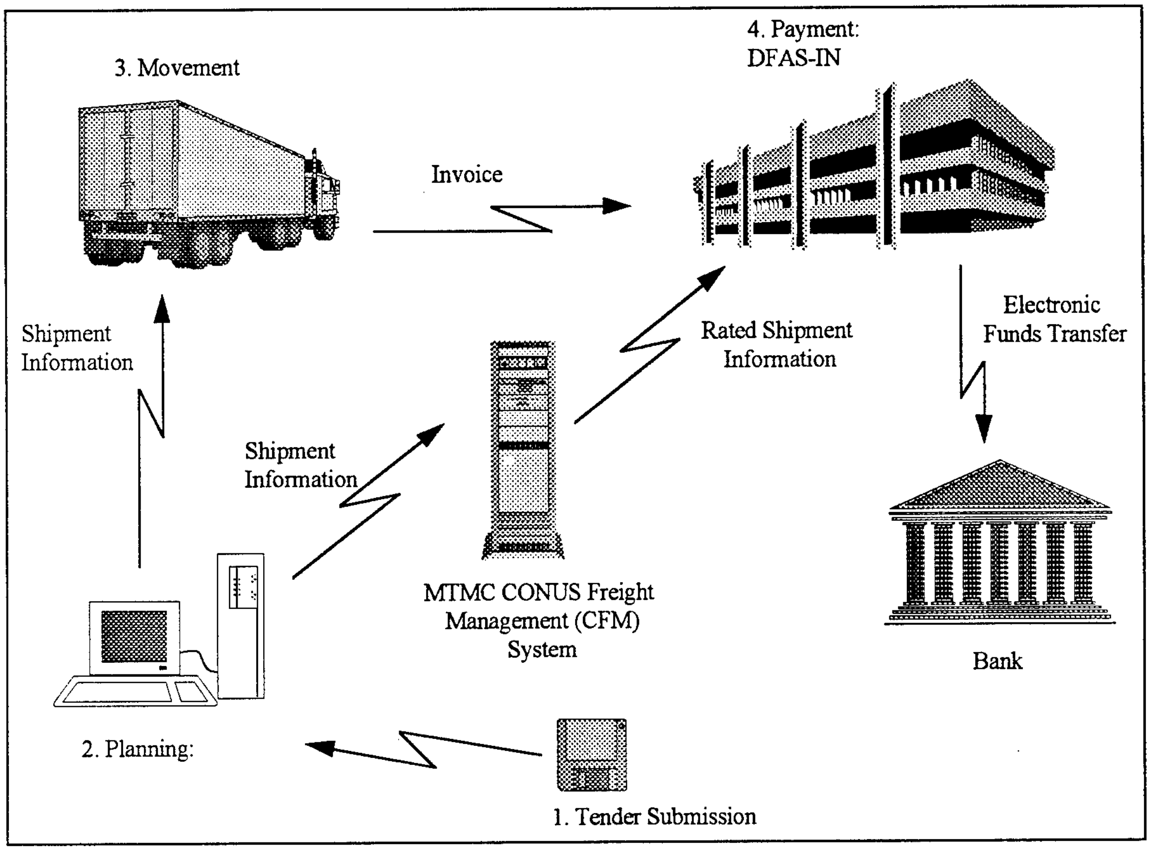

Figure 4. DTEDI Operating Concept (DoD, 1995a: 1-7)

Tender Submission. Before shippers can satisfy their transportation needs, they must have access to information concerning carrier rates. Three DoD Components manage carrier rate information: Military Traffic Management Command (MTMC), for ground transportation; Air Mobility Command (AMC), for air transportation; and Military Sealift Command (MSC), for sea transportation (DoD, 1996a: 3-1). Through these three Transportation Component Commands (TCCs), USTRANSCOM plans to automate the transportation rate filing process in three areas: guaranteed traffic (GT), voluntary/ negotiated tenders, and overseas rate agreements.

Guaranteed Traffic (GT). Guarantee traffic is an attempt to automate the processing of nearly 9,000 complex rate tenders. This plan calls for MTMC to develop an automated system to create electronic solicitations, receive electronic bids, evaluate and award the bids, and electronically distribute GT rates to CONUS Defense shipper systems (DoD, 1996a: 3-2).

Voluntary/Negotiated Tenders. Automation of MTMC's voluntary/negotiated tender process was completed in 1992. This system allows CFM to receive rates electronically. Currently, more than 100 commercial carriers are now exchanging rates with MTMC under this process. Carriers voluntarily submit electronic rates to MTMC, which checks the rates for compliance. If the rates are accepted, they are made available to Defense shippers. If rates are not accepted, carriers may resubmit rates after adjustments have been made. All of the accepted rates are forwarded to GSA for use in performing post audit procedures (DoD, 1996a: C-4).

Overseas Rates. Overseas rates are for moving freight using commercial carriers and maintained by MSC and AMC. These rates are governed by the Federal Acquisition Regulation (FAR) and the Defense Federal Acquisition Regulation

(DFAR). To date, MSC and AMC do not have EDI for overseas rate agreements (DoD, 1996a: C-4).

Planning. The planning area requires shippers, TCCs, and carriers to develop and implement EDI procedures in three different areas: movement requests, routing and rating, and carrier booking (DoD, 1996a: C-6).

Movement Requests. Movement requests are made by one of three customers: DoD supply activity, unit move office, or installation customers. These customers submit a movement request to the transportation officer at the depot or installation Traffic Management Office (TMO). Once this is done, the Transportation Officer (TO) enters the data into the local transportation planning system, which sorts and combines shipments with other requests by mode or destination. Currently, EDI applications are available only in the wholesale material management system. A schedule for converting paper to electronic transactions within the installation transportation system has not been established (DoD, 1996a: C-6).

Routing and Rating. Once the shipper has planned the movement of materials, the shipper then submits an electronic routing request to MTMC. After receiving this request, MTMC sends the shipper, via EDI, a list of potential carriers and their rates. The shipper uses this information to choose a carrier. This process is still in its infancy and not yet operational (DoD, 1996a: C-8).

Carrier Booking. Except for MTMC's container booking system, no other shipper or port incorporates an electronic booking capability. Today, most shippers use telephones or facsimile equipment to maintain close contact with their carriers. Commercial carriers currently use their own form of EDI transactions to schedule appointments, book freight, and confirm and cancel bookings. Recently, the motor carrier industry began to define its practices for scheduling, updating, and canceling appointments (DoD, 1996a: C-10).

Movement. The movement area includes four processes: domestic shipment documents, overseas shipment documents, status information, and discrepancy reports (DoD, 1996a: C-12).

Domestic Shipment Documentation. The domestic shipment documents proposal is divided into two categories: bills of lading from the shipper to the finance center and bills of lading from the shipper to the carrier, consignees, and others involved (DoD, 1996a: C-12).

Domestic shipment activities need the capability to electronically process Government Bill of Ladings (GBLs), Commercial Bill of Ladings (CBLs), and other essential commercial information. Also, DoD shipping activities must be able to electronically exchange bill of lading information with Defense Finance and Accounting System-Indianapolis (DFAS-IN), GSA, MTMC, consignees, and the commercial carriers in order to support the GBL payment program. In support of the DoD's ITV program, USTRANSCOM's GTN system must receive electronic shipment information from the participating DoD shippers (DoD, 1996a: C-12).

In support of the GBL payment program, DFAS-IN receives more than 180,000 electronic GBLs annually from the Defense Logistics Agency (DLA). Yet DFAS-IN needs to increase the number of GBLs it receives electronically before it can analyze the projected economic benefits from the electronic payment program (DoD, 1996a: 3-3). In an attempt to increase shipper participation, the Under Secretary of Defense for Acquisition and Technology and the Under Secretary of Defense (Comptroller) directed all DFAS-IN trading partners to accelerate their implementation of EDI GBLs. Furthermore, USTRANSCOM has been tasked to serve as test director and perform a formal systems integration test. In addition, the Defense transportation community is devising a plan to implement electronic CBL capability (DoD, 1996a: 3-3).

The central repository for all electronic bills of lading is MTMC's CONUS Freight Management (CFM) system. After receiving bills of lading from the shipper, CFM forwards them to DEFAS-IN. The DTS is examining the plausibility of using the CFM system to forward bills of lading to all trading partners involved in the movement process (DoD, 1996a: 3-5).

Overseas Shipment Documentation. Shippers use various shipping documents to move cargo to ports of embarkation (POE). However, many POE's lack the resources to process such a variety of EDI document formats. Similarly, many ports of debarkation (POD) lack the resources to exchange EDI formats with foreign carriers.

This complex process presents a challenge for EDI use in the DTS. Responding to this challenge, USTRANSCOM called for the implementation of a joint theater transportation system by late 1997 (DoD, 1996a: 3-4).

Status Information. For the DoD ITV program to work efficiently, each node in the process needs to generate accurate and detailed shipment status information on all movements within the process. Through the Defense Automatic Addressing System (DAAS), information such as the National Stock Number (NSN) and Transportation Control Number (TCN) could be passed to the GTN system (DoD, 1996a: C-22).

Discrepancy Reports. The Defense transportation community is planning on using the American Standards Code (ASC) X12 Non-conformance Report as a means of reporting discrepancies during the cargo movement. It will be a requirement for all nodes to generate a discrepancy report when the contents of a shipment do not match the description of the associated movement documentation. This report will be used during the file claims process (DoD, 1996a: 3-5).

Payment. The payment area is divided into three separate areas: invoices, carrier payment, and claims (DoD, 1996a: 3-5).

Invoices. DEFAS-IN is responsible for paying all CONUS freight GBLs. It uses the Defense Transportation Payment System (DTRS) to electronically collect invoice and shipment information from carriers and DoD shippers. Once these invoices are reconciled, carriers can then be paid (DoD, 1996a: 3-5).

Carrier Payment. Annually, MSC pays 52,000 invoices for approximately 1,000 ocean cargo shipments, while DFAS-IN pays more than 1 million invoices for domestic freight shipments. Though EDI is expected to avoid significant costs associated with data entry and provide and efficient operating environment for conducting prepayment auditing, the electronic payment process is only in the planning stages. The operating concept calls for DFAS-IN's DTRS to furnish the data needed for electronic funds transfer (EFT) to the standards accounting and distribution system. Unlike other EDI efforts, EFT requires a three-way relationship between the DoD, participating banks, and carriers (DoD, 1996a: C-29).

Claims. To illustrate the importance of automating the claims process, it has been estimated that DFAS-IN receives approximately 15,000 claims annually (DoD, 1996a: 3-6). Once the determination has been made that the carrier owes the government for loss or damage, an EDI transaction would then request payment from the carrier. Carriers have 120 days to dispute the claim or pay their debts. If dispute responses or payments are not made within 120 days, a debt notice will be set using ASC

X12 Claims Tracer. Finally, as a last resort, the carrier could be asked to offset a future payment for the damages incurred on the claim.

Though the initial focus of the DTEDI program was designed to support electronic audit and payment of freight and personal property shipment invoices, the EDI infrastructure established will enable the DoD to capture valuable source data for ITV purposes.

On-going EDI Initiatives.

HQ USAF/LG is involved in two EDI projects that deal directly with commercial operators. One of them concerns the EDI GBL process that serves the DTS community. This project is in the early stages of development. The other project involves the Standard Transportation Industry Information Processor (I2P) (Wakeley, 1996).

Government Bill of Lading (GBL). Currently, during the GBL process, when TMO makes a shipment they end up making several paper copies of the GBL that are sent to several key agencies within the transportation process. One copy goes to DEFAS-IN, another to MTMC, another to the carrier, and a forth copy goes to the consignee (Wakeley, 1996).

HQ USAF/LG is trying to eliminate paper products and replace them with electronic data. Refer to figure 5 as each step in the GBL sequence is discussed.

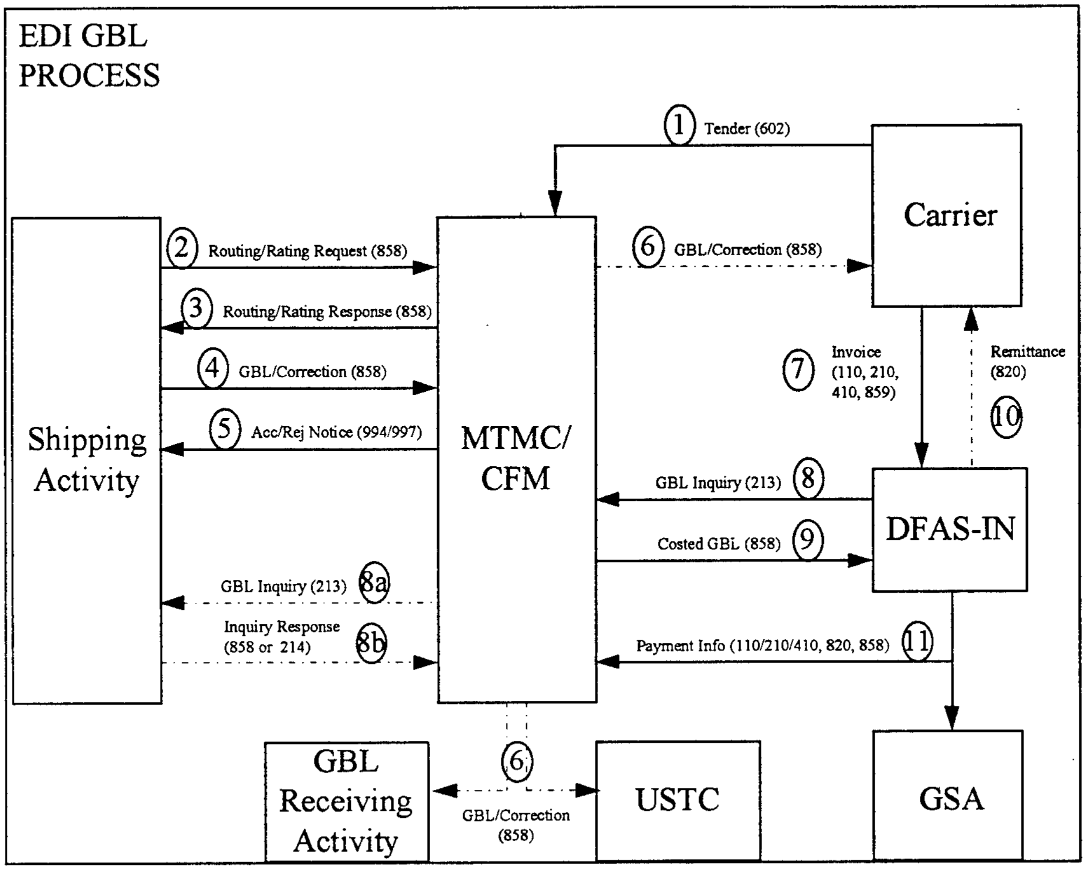

Figure 5. EDI GBL Sequence (Wakeley, 1996)

When the commercial carrier wants to do business with the government, he makes arrangements with MTMC, saying he's available to do business. He essentially provides an electric tender of service that says "I will do business over these routes, for these commodities, and for this price." ① MTMC/CFM then stores and maintains this electronic tender within its information system (Wakeley, 1996).

Later, when there is a shipping activity requirement, MTMC searches the database and determines which carriers meet the requirements ②. Once this process is completed, MTMC sends the shipper a list of potential carriers ③. This list is rank ordered by price.

TMO may go through a few carriers on the list before finding a carrier that is able to support the request (Wakeley, 1996).

Once the carrier and pick-up date is known, the GBL is prepared ④. The GBL is not actually sent to MTMC until the cargo departs the loading dock. MTMC either accepts or rejects the data notice ⑤. Once everything is in order and MTMC has accepted the information, the GBL is sent to CFM which becomes involved in the distribution of electronic information (Wakeley, 1996).

CFM interacts with the carrier, the consignee, and USTRANSCOM ⑥. This interaction provides USTRANSCOM with the GBL number, TCN number, timing information, commodities involved, mode of transportation and destination. This information provides some ITV over the shipment (Wakeley, 1996).

When the carrier makes the delivery, the carrier then sends MTMC an invoice requesting payment ⑦. MTMC receives the GBL information and searches the database looking to link this information to the earlier request ⑧. This information is then pushed to DEFAS-IN without ever being requested ⑨. Currently, DEFAS-IN pays the carrier by check; eventually this will be replaced by EFT ⑩. Finally, information is constantly sent back and forth to MTMC and GSA where it is stored for future audit purposes (Wakeley, 1996).

<u>Standard Transportation Industry Information Processor (I2P)</u>. I2P is another EDI process that has altered the DoD relationship with the commercial air express carriers. In the past, if the DoD wanted to exchange EDI information with various

commercial carriers, the DoD would have to have a separate terminal for each carrier. These separate terminals could not interface with each other. Not to mention, each terminal produced a carrier specific bar code label. Figure 6 illustrates how this process increases potential duplicate data entry errors as the information was manually in-putted into each separate system. The old process was non-standard, time consuming, and an ineffective use of EDI technology (Wakeley, 1996).

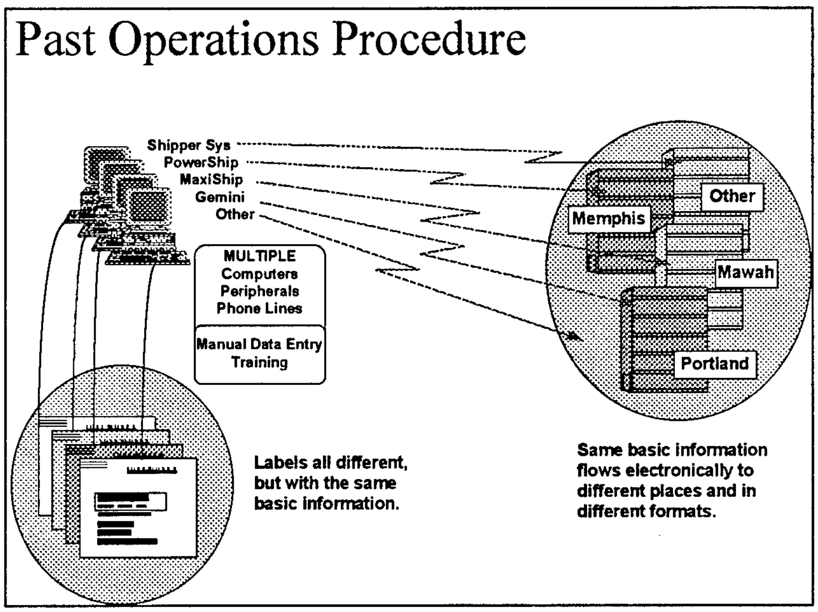

Figure 6. Past Operating Procedures (Wakeley, 1996)

The concept of I2P basically involves taking the commercial software that Federal Express, UPS, and Emery Worldwide use and places this software into Cargo Movement Operations System (CMOS) (Wakeley, 1996). Since CMOS supports Air Force TMO operations worldwide, it provides an EDI push at the end of the day with the manifests for that day's business. What this does for the base level users, is that it allows them to be a "one machine operation." Figure 7 shows how operators no longer have to move data by typing between the UPS system and the government shipper system. I2P generates both a paper manifest and an electronic manifest that goes to the carrier who processes the shipping label. This shipping label provides a place for the DoD to print essential data needed for tracking. Once pick-up and delivery have been accomplished, the carrier will send an invoice to the TMO requesting payment. The TMO, using the DoD "one machine operation" system, verifies that the shipment has been made and processes the voucher which is later sent to accounting and finance.

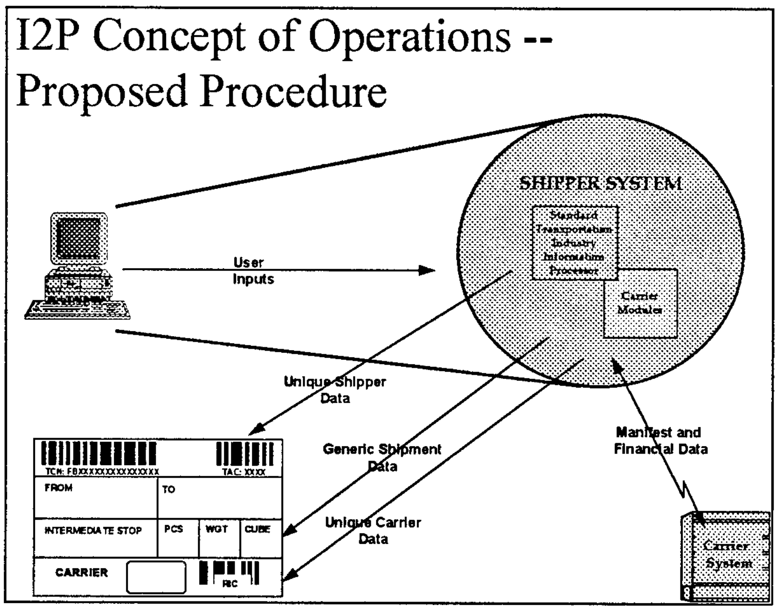

Figure 7. I2P Operating Concept (Wakeley, 1996)

Automatic Identification Technology (AIT). AIT may best be recognized in the bar-codes seen in everyday purchases. The rest of the world, to include segments of the Air Force, have been using AIT with great success to improve productivity, information accuracy, and system integrity (AFMC, 1995: 1). AIT can be defined as any technology that automates the collection of data and transfers that data to a database. Benefits include greater speed, accuracy, system integrity, reduced paperwork, and greater exchanges of information. Two examples of AIT are bar-coding and radio frequency identification technology.

<u>Bar Coding</u>. Bar codes are printed, scanned, decoded, and then forwarded to a host computer (Ross, 1996). This technology relieves the user of the tedious and error-prone task of having to read an alphanumeric label on an object and then transcribing the contents of the label onto a paper form or key-entering it into a database.

While the DoD has been using bar codes since the early 1980's, bar codes initially found their way into the commercial markets in the early 1970's (Ross, 1996). Within the DoD, MIL-STD 1189B is still the governing standard for bar coding. Traditionally, there are two types of bar codes, linear bar codes and two dimensional bar codes.

<u>Linear Bar Coding</u>. A linear bar code is an array of parallel lines, varying in thickness, placed next to each other that represent a single character in a particular symbology. The symbology defines how the bars and spaces are to be arranged on the label. According to an AIT market study published by the Air Force Automated Identification Technology Program Management Office, some of the more popular linear bar codes are found in Table 4 (AFMC, 1995: 2).

Table 4. Linear Bar Code Types (AFMC, 1995: 2)

Code	Length	Symbology
UPC	Fixed	Numeric
2 of 5	Variable	Numeric
3 of 9	Variable	Alphanumeric (Uppercase letters and some special characters)
128	Variable	Alphanumeric (full ASCII character set)

After evaluating each type of bar code, the DoD selected code 3 of 9 as its standard. Code 3 of 9 consists of a set of 43 numeric, uppercase letters and special characters. As technology progressed, code 128 was developed. This code possess some unique advantages over code 3 of 9. Code 128 offers higher coding densities making it possible to print smaller bar codes with more data. It also supports the full ASCII character set, and seems to be the focus of many industry and standards groups. Yet, code 3 of 9 will remain the DoD's bar code standard until a cost analysis investigation merits switching to code 128 (AFMC, 1995: 2).

Two Dimensional Bar Coding. In generic terms, two dimensional bar codes usually refer to a larger capacity bar code. Some examples are datamatrix, Code 1, Maxicode, and PDF417. Typically, linear bar codes have the capability to hold up to 17 characters, while two dimensional bar codes can store up to 2,000 characters in a relatively small space (6 inch square). Furthermore, two dimensional bar codes can withstand considerable damages and still maintain readability. Although linear bar codes will remain the dominate bar code symbology for the near future, increased growth in two dimensional bar codes is expected (AFMC, 1995: 2).

Radio Frequency Identification (RFID). A relatively new approach to automatically identifying, categorizing, and locating people and assets over a relatively short distance, is the notion of RFID. RFID labels are commonly known as "tags" or "transponders". These tags have the capacity to hold up to 128K bytes of variable memory which can be programmed by a controller unit, commonly referred to as a reader or interrogator, using RF radiation (AFMC, 1995: 15).

The Air Force AIT Program Management Office describes the RFID process as

> interrogators communicate with tags through the use of radio frequency (RF) energy. The interrogator sends out an RF signal which 'wakes up' the tag, and the tag transmits information back to the interrogator via RF. In addition to reading the tag, the interrogator uses RF energy to write information back to the tag. This enables the user to alter the information stored in the tag from a distance. Interrogators can be networked together so as to provide nearly unlimited coverage for a system. (AFMC, 1995: 17)

The potential applications for RFID technology are numerous. Short range tags could be used in factories to track items through their production cycle, while longer range tags are being used in the transportation field. Commercial trucking companies, rail cars, and intermodal container carriers are all using these systems to track and monitor their assets as they pass certain "check points" along their intended route. This provides near-real-time location data to a central collection database. There are many other potential uses for this technology both in military and commercial applications, especially as the RFID cost continues to decline (AFMC, 1995: 17).

Table 5. RFID Tag Attributes (Gross, 1995: 4-2)

Manufacturing Company	Active or Passive	Line of Sight Requirement	Read/Write Capability	Memory Size
ASGI	Passive	Yes	Yes	115 BYTES
AT/Comm	Active	No	Yes	10 KB
ID System	Active	No	Yes	64 KB
Intellitag	Passive	No	Yes	2 MB
Rand Technologies	Active	No	Yes	128 KB
Saab Scania Combitech	Passive	No	Yes	8 KB
Savi Technology	Active	No	Yes	128 KB
Single Chip Solution	Passive	Yes	Yes	1 KB
Texas Instruments	Passive	No	Yes	512 BITS
XCI	Passive	Yes	No	26 BITS

Table 5 illustrates some of the many different manufacturing companies involved in AIT systems. The table identifies each system as being active or passive, line of sight requirement, read/write capability, and memory size. For example, ASGI manufactures a passive, line of sight, RFID tag possessing read/write capability with a memory size of 115 BYTES.

AIT offers the possibly to greatly enhance the efficiencies of collecting shipment data. These technologies can be applied to the sources that feed GTN. By combining AIT with the computer sources that feed GTN, human resource requirements and data input errors could be minimized (Ross, 1996).

Data Standardization

Effective ITV is only possible if the DoD and commercial systems provide timely and complete data with a high degree of accuracy. GTN prototypes have repeatedly experienced deficiencies while trying to provide data with those attributes. For example, in April 1993, AMC and MTMC estimated that their POEs received Advanced Transportation Control and Movement Documents (ATCMDs) on fewer than 45% of all shipments (DoD, 1995a: 2-5). Shipment processing delays, lack of commercial vendor compliance, delays at air clearance authorities, and batch processing all attributed to this low percentage. Furthermore, is was discovered that the GTN prototype was unable, in many cases, to respond to user inquiries, primarily due to misinterpreting existing transportation policies, standards, and procedures. Processing of GBLs and CBLs also experienced similar quality and timeliness problems.

Human Interface Issues. Even in relaxed and ideal working conditions, key punch operators typically make one mistake for every 300 entries. This error rate can increase dramatically when workers are operating under less than ideal conditions, e.g., increased workloads, time constraints, uncomfortable temperatures, etc (Bunn, 1996).

According to HQ AMC/DOU, AMC has a goal of attaining a 2% operator input error rate. AMC has demonstrated considerable improvements toward this goal, but 1996 2nd quarter metrics demonstrate more work still needs to be done. Error rates peaked at 83% for one base during the month of April. The 2nd quarter figures further illustrate how approximately 50% of the bases who process electronic messages fall within the 20% or greater range of experiencing operator errors. Table 6, extracts from 2nd quarter metrics, illustrates how bases familiar with cargo movement rank. Surprisingly, these bases who routinely process cargo still possess a rather high operator error rate.

Table 6. April Sample Extraction Error Rates (Baer, 1996)

European

AMC Unit		% error	Rejects	Messages
437 AW	Charleston	13.31	299	2246
625 AMSS	Rota	41.05	39	95
623 AMSS	Ramstein	25.02	698	2790
436 AW	Dover	19.20	320	1667
Totals:		19.95	2093	6798

Pacific

AMC Unit		% error	Rejects	Messages
62 AW	McChord	10.91	166	1522
60 AMW	Travis	10.59	306	2889
635 AMSS	Hickam	8.00	77	962
633 AMSS	Kadena	27.25	263	965
631 AMSS	Osan	18.05	76	421
Totals:		13.14	888	6759

A typical European mission scenario, with stops in Charleston, Rota, Ramstein, and Dover, displays an operator error rate of 19.95%. This error rate does not come close to the AMC goal of 2% operator error rate.

Reasons for reject include invalid wing/group and squadron designators on the departure messages, incorrect aircraft type designators, attempts to add existing information, invalid aircraft tail numbers, invalid ICOAs, and invalid tasked unit designators. Many of these errors were syntax errors that could have been avoided if computer software contained some sort of logic component that prevented the operator from proceeding to the next step (Baer, 1996). For example, when an operator types "C5B" the computer should recognize that this is not the proper aircraft type and prevent the operator from advancing to the next information block. If the operator was confused, he should be able to select a drop down table that allows him to "point-and-click" C005B, the correct response . This type of logic can easily be applied to many of the existing errors found throughout the DoD transportation system. The complete detailed report of operator error metrics for the 2nd Quarter of 1996 can be found in Appendix C.

EDI Transaction Set Standards. For electronically transmitted documents to make sense between two trading partners' computers, the data that is sent must be formatted to a uniform standard. Standards are defined as the technical documentation approved by the American National Standards Institute (ANSI) Accredited Standards Committee (ASC) X12 (Payne and Anderson, 1991: 3). Standards provide the framework for how specific EDI messages are formatted. The Federal Information Processing Board Publication 161 (FIPS-161) dated September 1991, requires all Federal agencies that exchange business information electronically to use existing X12 standards (DoD, 1996b).

Transaction Sets. A transaction set is defined as a block of information in EDI, making up a business transaction or part of a transaction (DoD, 1996b). Each transaction set used in the DoD meets ANSI X12 criterion and will replace paper documents currently used throughout the procurement and transportation process. Each transaction is made up of a collection of data segments that are formatted from data elements. These data segments logically relate data elements in a defined sequence. A data segment is analogous to a postal address and a date element is analogous to one item out of that address such as a city.

Interchange Control Structure. While the EDI standards establish the basic structure of EDI messages, the standards alone are not sufficient to establish exactly what is to be communicated between trading partners. For example, the standards allow for a product to be identified through the use of a product identification code; however, the standards do not specify which code should be used. These decisions are left up to the trading partners to decide. In other words, transaction sets are customized to each trading partner in the process. This process is known as mapping. Mapping is an essential part of EDI because it establishes the ground rules for the company's EDI effort with the DoD (DoD, 1996b).

In addition to ANSI X12 standards, there are three other principal standards that are being used. They include Electronic Data Interchange for Administration, Commerce, and Transport (EDIFACT), Open Standard Interconnection for E-Mail (X.400), and Open System Interconnection for Directory Services (X.500). The most widely used of these are the EDIFACT standards. While the ANSI X12 standards apply to only American business and industry, the EDIFACT standard was developed by the United Nations Economic Commission for facilitation of international trade procedures as the single international EDI standard. Speculation among members of the EDI community believe there will be a gradual migration from X12 standards to the EDIFACT standards. Therefore, the ANSI X12 committee has decided to align the X12 standard with EDIFACT by 1997 (DoD, 1996b).

Standardizing Transportation Procedures. Outdated or redundant regulations, such as Personal Property Traffic Management Regulation (PPTMR) and Military Standard Transportation and Movement Procedures (MILSTAMP), which often uses antiquated standards and formats and, in some cases, require the use of different codes for the same purpose are being replaced by the new Defense Transportation Regulation (DTR). In response to inaccurate and untimely data transactions, USTRANSCOM is currently developing a new DTR that amalgamates, simplifies, and replaces existing standards and procedures (DoD, 1995a: 2-5).

Consistent with the intent of Vice President Gore's National Performance Review, DTR is USTRANSCOM's effort to consolidate 38 publications, or approximately 2,200 page of regulations, into one, comprehensive publication. The concept behind DTR is to provide a single "shipper level" publication for the Installation Transportation Officers (ITOs) and TMOs. This comprehensive publication will streamline, simplify and update procedures and eliminate duplication and conflicts between existing regulations (Owenby, 1996).

Pertinent portions of DoD 4500.32-R, MILSTAMP, will constitute the nucleus for DTR development. The four major areas of DTR, as well as their current development status, are covered below (DoD, 1994: 3):

> Part I, Passenger - emphasizes priority use of CRAF carriers, increases the Transportation Officer (TO) authority for routings in CONUS, clarifies use of a special assignment airlift mission (SAAM), outlines the use of operational support aircraft (OSA), and details/shortens the process for obtaining AMC reservations. (Developed Jul 1994 and signed by DUSD(L), 4 Aug 95)
>
> Part II, Cargo - allows TOs to route in CONUS with no limits, eliminates arbitrary routing limitations, establishes export release procedures based on containerized

and non-containerized cargo, and sets forth EDI procedures for GBL preparation (Developed Aug/Sep 1994 and signed by DUSD(L), 22 Apr 96)

Part III, Mobility - emphasizes deployment, sustainment, and redeployment operations, details unit air and surface movements guidance, and addresses humanitarian/peacekeeping operations. (Developed Jan 1995 and should begin 3rd draft coordination, Jun 96)

Part IV, Personal Property - allows members to have more control and involvement throughout their entire move, ensures only "top notch" quality carriers will be afforded DoD business through proven customer satisfaction, and ultimately shifts property movements towards commercial business practices. (Developed Oct 1995 and should begin initial draft coordination Jun 96)

Each volume will include movement and standardization issues -- peacetime as well as contingencies, administrative information, general information, and will explain how to propose policy and procedural changes through the use of functional process improvement programs.

Summary

Due to the shrinking size of our airlift fleet and the reduction of depot inventories, ITV is a necessity for an effective logistics system. With considerably less money to maintain a high operating tempo, the DoD either has to: 1) sacrifice readiness or 2) find a more efficient and effective way to conduct business. Since option one is not a feasible solution, the DoD must concentrate on option two.

USTRANSCOM believes that through the efficient and effective use of the GTN system, the DTS could yield a tremendous savings while providing accurate and timely transportation data. Systems like GTN coupled with emerging technologies, such as EDI and AIT, are critically important for ITV and TAV. The road leading to system migration will not be easy. Therefore, under the control of USTRANSCOM, the JTCC is focused on eliminating system duplication while providing a cost effective solution. Another problem facing GTN is inadequate compliance to existing transportation policies, standards and procedures. In response, USTRANSCOM is currently developing a new DTR that will simplify and replace existing standards and procedures. Effective and efficient information processing is a key ingredient that will make USTRANSCOM a success or a failure.

III. Analysis

Overview

In-transit visibility means different things to different customers. For example, a theater CINC may be interested in acquiring information concerning his theater force structure and capabilities, while logisticians are concerned about the sustainment of those forces. Therefore, data requirements are dependent on customer demands. This chapter examines some of the implications associated with the GTN system, information capturing technology, and data standardization.

Global Transportation Network (GTN)

In the past, automated transportation systems were built individually to meet specific customer demands. Within the each military service, these transportation systems were typically managed by a single manager for air, land, and sea. This resulted in a complex web of systems that provided valuable services but collectively failed to provide necessary data to centrally manage the entire transportation information network. With the implementation of GTN, USTRANSCOM will have the capabilities required to collect, integrate and manage the entire transportation network (Boynton, 1996).

Although USTRANSCOM has made considerable progress in laying the foundation, through GTN, for DoD-wide ITV capability USTRANSCOM cannot overlook the fact that the legacy systems feeding GTN were primarily built as stovepipe systems (Bunn, 1996). Figure 8 illustrates how these systems were not built as integrated systems. They were built primarily for financial management. They were never built for

ITV, their ITV role evolved as a by-product. Prior to the GTN system, if details about the shipment were needed to complete the manifesting or billing procedures, tracer actions could be performed with available information. However, this was never called ITV.

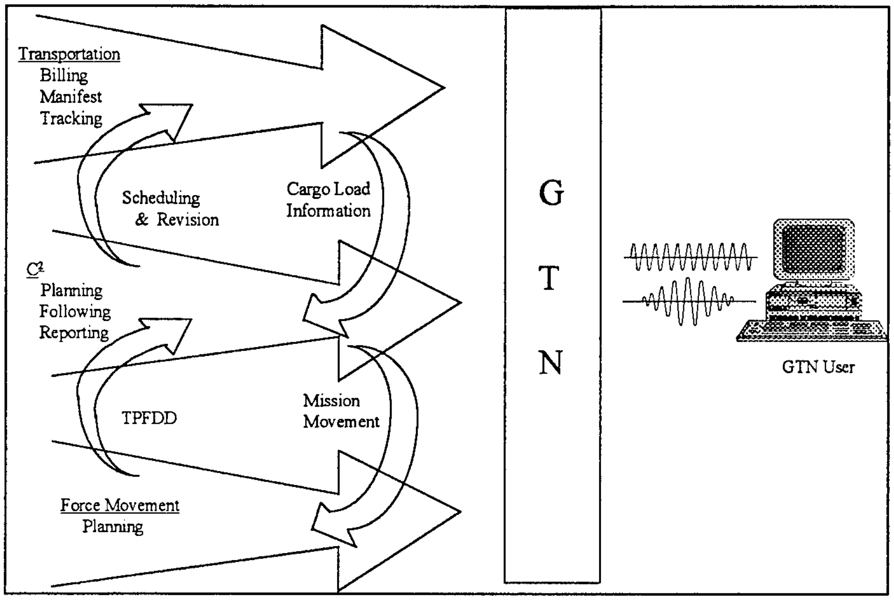

Figure 8. System Stovepipe (Bunn, 1996)

GTN Benefits. The primary benefits of GTN are enhanced warfighting capabilities and reduced operating costs (DoD, 1995a: 4-1). The "ability to divert and reconstitute shipments, exercise sound traffic management, and ensure personnel and material reach their destination in a timely and complete manner" enhances DoD's warfighting capabilities (USTRANSCOM, 1995a: 2-3). An effective GTN system is a force multiplier because it gives the theater CINCs confidence in their logistical support, allowing them to make swift and accurate decisions.

The GTN will enable customers to access essential logistical information such as transportation schedules, itineraries, and associated manifests. This capability will afford pipeline efficiency, thus providing a better means of tracking cargo, passengers, patients, units and forces. Information concerning customers is also a benefit for providers of transportation through the GTN system (USTRANSCOM, 1993a: 1).

Reducing operating costs is still another benefit of the GTN system. Reducing operating costs is achieved through improved efficiencies in both supply and transportation operations. The efficiencies of GTN include knowledge of total flow of cargo and passengers, the ability to forecast transportation requirements with greater accuracy. It will also eliminate uncertainties within our transportation pipeline and reduce the "perceived need" for reordering critical supplies (USTRANSCOM, 1995a: 2-3).

"In general, GTN will satisfy user's ITV requirements through user-controlled views of integrated transportation data. This data includes combinations of mode, locations, dates, and status with a variety of unit, force, cargo, passenger and patient identifiers" (USTRANSCOM, 1993a: 1).

Joint Transportation Corporate Information Center (JTCC)

As part of the JTCC's migration strategy, the JTCC proposed a new baseline to reduce functional redundancies among systems (DISA, 1995b, 1). This baseline will result in fewer individual systems and increase system integration. Vast amounts of information will be made available to GTN's users by tapping into a wide range of separate systems and consolidating the information in a well structured database.

The implications associated with the migration strategy of systems within GTN when fully mature will yield profitable returns. Though GTN utilizes several legacy systems, it will be able to tap, sort, and manipulate dozens of military and commercial transportation databases used to track the progress of USTRANSCOM's global transportation management mission (Bunn, 1996). Table 7 depicts the systems destined to interface with GTN. USTRANSCOM has come to realize the importance of process ownership -- it is the key to success

Table 7. GTN System Interface (DISA, 1995b: 24)

System	Direction of Interface	Data Exchanged
Curent Interfaces / Intransit Visibility (ITV)		
DAAS	To GTN	MILSTRIP/MILSTAMP Order and Status Transactions
CAPS II	To GTN	Aircraft Cargo Manifests and Cargo Status
HOST	To GTN	Aircraft Cargo Data (Contingencies)
PRAMS	To GTN	Passenger Manifest Data and Commercial Itinerary Information
GDSS (Unclassified)	To GTN	Airlift Mission Schedules, Aircraft Arrival/Departure Times, Aircraft Status, Advisory Notices, and Summary Passenger/Cargo Information
DASPS-E/WPS	To GTN	Cargo Arriving, Departing, and On-Hand at OCONUS Water Ports
TERMS/WPS	To GTN	Cargo Arriving, Departing, and On-Hand at CONUS Water Ports
METS II/IBS	To GTN	Surface Cargo Booked for Ocean Shipment and Schedules for Ships Moving Military Cargo
Future Interfaces / Intransit Visibility (ITV)		
DAAS	From GTN	Shipment Status
DTTS	To GTN	CONUS Truck Shipment of AA&E
GDSS (Add Classified Capability)	To GTN	Airlift Mission Schedules, Aircraft Arrival/Departure Times, Aircraft Status, Advisory Notice, and Summary Passenger/Cargo Information
IC3 (Both Classified and Unclassified)	To GTN	Ship Schedules/Movements and Ship/Port Characterstics
WPS Central Database	To GTN	Worldwide Data from WPS and IBS Systms
CFM	To GTN	Cargo Bookings, Schedules, and Movements on Commercial Land Carriers
GCCS	From GTN	ITV Data
JOPES	To GTN From GTN	Reference File Updates Status of Movement of Forces and Sustainment Required by TPFDD
STACCS	To GTN From GTN	Information on Forces Departing EUCOM Unit/Non-Unit Movements Data, including Data on Carriers
DAMMS-R	To GTN From GTN	Units/Materiel Departing Theater Carriers, Bookings, Departures, Itineraries, Schedules, and Cargo/Passenger Manifest
ATCCS	From GTN	Departures, Itineraries, and Schedules for Aircraft Moving Cargo to/from ALCs
USSTRATCOM	From GTN	Status of Aerial Refueling Tanker Assets and USSTRATCOM Cargo
TC-AIMS	To GTN	Shipments Outside Normal MILSTAMP Channels
USTRANSCOM COOP SITE	To GTN FROM GTN	Supports Continuity of GTN ITV

Table 7. (Continued)

System	Direction of Interface	Data Exchanged
Curent Operations		
IDHS	To GTN	Transportation Infrastructure
GCCS	From GTN	Current Operations Data
CDSS	From GTN	Decision Support Data
USTRANSCOM COOP SITE	To GTN From GTN	Supports Continuity of GTN Future Operations
Future Operations		
JOPES	To GTN From GTN	TPFDDs Updated TPFDDs
GCCS	From GTN	Future Operations Data
USTRANSCOM COOP SITE	To GTN FRom GTN	Supports Continuity of GTN Future Operations
Patient Movement		
CHCS	To GTN FRom GTN	Patient Movements Aircraft Movements
TAMMIS	To GTN FRom GTN	Patient Movements Aircraft Movements
DHCP	To GTN FRom GTN	Patient Data/Bed Availability Patient Data Request
USTRANSCOM COOP SITE		Supports Continuity of Patient Movement

Users of GTN will be able to selectively request and retrieve data as needed (USTRANSCOM, 1995b: 2-4). A variety of tracking methods and/or information databases will be accessible to its users. Selective retrieval will be possible by any of the following avenues:

- movement category (passenger, cargo, etc.)
- database type (operational or historical)
- mode of transportation (air, surface, sea)
- geographic area (worldwide, regional, or specific location)
- direction of movement (inbound or outbound)
- delay in processing (awaiting further movement)
- specific time-frame

Information Capture

DoD EDI Integration

Computer technology offers its customers the capability to eliminate information constraints posed by time, geographic location, or organizational boundaries. EDI offers suppliers the ability for prompt and courteous handling of customer inquiries concerning shipment location, condition, and payment (Udo, 1993: 35). Other benefits from EDI include the transfer of accurate and timely information. This quality is imperative to compete in today's transportation industry (Schultz, 1993: 51).

It is important that all DoD components work in concert and allocate the necessary resources to help facilitate the EDI implementation plan. While initially focusing on supporting the electronic payment of GBLs for freight and personal property shipments, the EDI Implementation Plan has expanded this view to include using EDI techniques in all transportation processes--tender submission, planning, movement, and payment (DoD, 1996a: 3-1).

Tender Submission. As illustrated in Figure 3 of chapter II, implications associated with the EDI tender submission processes, once fully operational, will allow EDI participating carriers to submit electronic rates to MTMC/CFM using ASC X12 Transaction Sets, Standard Tender of Freight Services. EDI transactions also allows CFM the opportunity to check the data for compliance and then either accept or reject the carrier's rates. If the rates are rejected, the carriers are allowed to resubmit the information, once again using EDI formats. If the rates are accepted, they are electronically forwarded to GSA for use in performing a GBL post-payment audit (DoD, 1996a: C-2).

Planning. The operating concept of routing and rating assumes the shipper has already planned the movement of material. EDI technology allows the shipper the opportunity to submit an electronic routing request to MTMC using ASC X12 Transaction Sets, Shipment Information. Once MTMC receives this electronic information, MTMC is able to identify a list of suitable carriers along with their rates and then forwards this data, via EDI, back to the shipper. This data allows the shipper the opportunity to select a carrier. The EDI transactions eliminate the lengthy time constraints associated with previous paper products. A process that took weeks and sometimes months, now is reduced to hours or days (Bunn, 1996).

Movement. The movement area includes four processes: domestic shipment documents, overseas shipment documents, status information, and discrepancy reports. EDI gives the shipper the information needed for tracking shipments and offers several advantages to the carrier. Competition requires transportation firms to respond quickly to market demands without increasing price or reducing quality (Udo, 1993: 35). Using EDI technology, the shipper and carrier get (Akard, 1993: 30):

- tighter estimated times of arrival
- around the clock monitoring of cargo
- cost benefits due to more effective use of fleet transportation
- better managed cargo through improved response time to customers

Overseas shipment documents are the largest and most complex of all DTEDI projects. GBLs, Transportation Control and Movement Documents (TCMDs), and commercial paper are all various shipping documents a shipper can use to move cargo to POEs. However, the POEs do not have the capability to receive electronic GBLs. They also lack the capability to create or receive other transportation documents using public EDI standards (DoD, 1996a: 3-4).

Once developed, EDI makes affordable the transfer and exchange of the Advanced Transportation Control and Movement Document (ATCMD) from shipper to clearance authority; bill of lading and other shipment data transactions from shipper to port of debarkation (POD); plus miscellaneous shipment data from POD to consignee (DoD, 1996a: 3-4).

Payment. As mentioned in chapter II of this research paper, the payment area is divided into three separate areas: invoices, carrier payment, and claims.

As EDI is implemented, a significant cost savings associated with data entry is expected to yield an efficient operating environment. Currently, AMC does not electronically process invoices. It maintains an accounting system that bills organic airlift services and pays commercial airlift carriers (DoD, 1996a: C-26).

Two benefits can be associated with paying commercial carriers electronically. First, it avoids the administrative costs associated with the billing process. Secondly, it reduces the number of employment positions otherwise used in the payment process and allows them to concentrate in other areas. These benefits can also be observed within the carrier's organization (Wakeley, 1996).

The implication associated with the EDI payment process requires DFAS-IN to furnish financial information needed for EFT to the standard accounting and disbursing system. The disbursing system would then be responsible for electronically transmitting payment using ASC X12 standards (Wakeley, 1996).

EDI / GBL. There are obvious drawbacks within the current DoD GBL system. First, there are entirely too many paper products capable of being delayed or lost within the system. Secondly, due to lengthy paper-trails, the consignee sometimes receives the shipment prior to receiving the GBL. Therefore, if an agency's system relies on an inbound data base, the agency is now forced to manually input the data -- it can become quite a problem (Wakeley, 1996).

Advantages to EDI applications concerning GBL's are numerous. EDI application provides a type of ITV over the shipping process. It will significantly reduce the workload at the carrier's and consignee's location because they will no longer have to manually input information into their systems. It will also streamline the operation centered around MTMC, thus reducing the time pipeline within the DTS (Wakeley, 1996).

The use of EDI offers vendors and carriers quicker payment possibilities. This is a big enticement for vendors and carriers who routinely contract with the government. A supplier can wait sometimes up to six months to get paid because of the government bureaucracy (Wakeley, 1996). Commercial carriers see EDI as a means to reduce their sales outstanding debts. For example, Emery Worldwide, Washington DC, days sales outstanding (DSO) are running about 44-45 days (McVeigh, 1996). Its goal is to reduce that figure to 30 days. DSO are defined as business days beyond the date when the invoice was sent. Calendar days are running about 63.9 days outstanding. At the time of this research, "open receivable account" in the Washington DC area was approximately \$3.9 million. The Washington area encompasses the Air Force, DLA, NASA, and a few other government agencies. Table 8 itemizes the receivable outstanding by number of days. According to Mr. Michael McVeigh, Emery Worldwide Senior Global Account Executive, if Emery could get their days sales outstanding down as a corporation by one day, it could have a potential impact of \$12 million in increased revenue.

Table 8. Emery Worldwide Open Receivables (McVeigh, 1996)

Open Recievables		
Days \$ Outstanding	**Receivable**	**% of \$ Outstanding**
0-30 days	\$1,482,000	38%
31-60 days	\$1,638,000	42%
61-90 days	\$468,000	12%
91 +	\$312,000	8%
	\$3,900,000	

Table 8 depicts how the percentage of "outstanding receivables" are distributed in the Washington territory. For example, 38% of the revenue outstanding falls within the 0 to 30 day range. In other words, \$1,482,000 of revenue outstanding is paid within the first 30 days of services. Consequently, 42% of the revenue outstanding falls within the payoff range of 31 to 60 days. This means that \$1,638,000 is not paid within the 0 to 30 day range, rather it gets paid in the 31 to 60 day range. As the table expands on this issue, it illustrates after 91 days, there is still $312,000 in revenue outstanding (McVeigh, 1996).

Commercial carriers are not overly pleased with the results to-date concerning the electronic GBL procedures (Wakeley, 1996). It is not so much the invoicing problem per say, or the invoicing system as a whole, they can move the data. The problem is that there are not enough shippers providing enough electronic information through the transportation system. This lack of information prevents DEFAS-IN from being able to match up the carrier's invoice with the customer's GBL. Because DEFAS-IN cannot find the electronic data on the government side, they reject the invoice and send it back to the carrier. This forces the carrier to produce and submit a paper invoice. Consequently, the process is not saving work, it is instead increasing the amount of work. So, DEFAS-IN is having a fairly difficult time finding carriers who are willing to participate in the DoD's EDI GBL system. Many of them are EDI capable but few of them are willing to jump on the bandwagon until the government can prove they are a reliable trading partner (Wakeley, 1996).

Another concern from the carriers is the DoD's stand on awarding the contract to the lowest cost bidder. How does the TMO measure carrier performance? Is performance based solely on customer comments/complaints? Since the TMO is still required to choose a carrier solely on price, does the TMO really know what the DoD is paying the carrier? Typically the bills are sent to DEFAS-IN, therefore the TMO never sees the total bill. Many value added carriers feel as though the process of selecting a carrier is broken. Value added carriers cannot compete at a level of price with the TMO.

Consequently, value added carriers tend to loose market share to carriers who do not provide EDI services, bar coding technology, and automated information systems (McVeigh, 1996).

Standard Transportation Industry Information Processor (I2P). Many of the carriers are looking forward to I2P. They see it as a way to become closer partners with the government and build a strategic alliance. Carriers are starting to line up and ask about I2P. Because of competitive requirements and management of government funds, the only incentive for the carriers is for the government to develop an automatic electronic payment process. Developing an electronic payment process will be difficult because it crosses the border between the functional communities of finance and transportation. Once a process for electronically paying these GBLs is established, the DTS will be able to take EDI GBL to its logical conclusion and provide the carriers with something they would like to see -- EDI application from start to finish (Wakeley, 1996).

Automatic Identification Technology (AIT). The ultimate benefits associated with AIT are a reduction in total operating costs and a streamlining of the flow of accurate information about inventory as it moves through the transportation pipeline (Forger, 1993: 50). Cost savings associated with increased speed and accuracy in automated data collection, and data transfer, are some of the benefits associated with item identification. Yet, not all commercial carriers, to include some organizations within the DoD, use AIT, such as bar codes and/or RF tags. Because of this, monitoring cargo movement is hampered (Manaco, 1995: 30-31).

Bar Coding. Bar coding reduces shipping process errors, helping to promote speed, efficiency, and reduced costs. Through the use of bar codes, cargo requires less handling within the pipeline, thus reducing the chance of human error (Adkins, 1992: 38). Bar coding provides an opportunity to improve data collection accuracy, reduce receiving operations time and data collection labor, and helps to integrate data collection with other databases. The instantaneous transmission of data also allows bar coding customers greater control of their inventory levels.

Linear Bar Coding. A drawback associated with bar coding is the fact that there are several types of linear bar codes on the market. DoD and commercial bar coding procedures must be compatible and capable of communicating with each other.

Two-Dimensional Bar Coding. Two dimensional bar coding offers its users the ability to store up to 2,000 alphanumeric characters, as opposed to linear bar codes that only offer the capability to store up to 17 characters. Another distinct advantage is that it can sustain considerable dàmage and still maintain readability (Ross, 1996). A current disadvantage to two dimensional bar coding is the fact that linear bar coding remains the dominate symbology, therefore bar coding reader incompatibility potentially exists within the transportation market (AFMC, 1995: 3).

Radio Frequency Identification (RFID). Another technology that is gaining increased popularity is RFID. A single RF tag can hold up to two megabytes of data depending on the type of tag. In addition to reading the tag, interrogators can use RF energy to write information back into the tag. This provides the means to alter the information stored in the tag from a distance. Interrogators can be networked together so as to provide almost boundless coverage for a system (AFMC, 1995: 17).

Line of sight requirements sometimes restrict the operating capabilities of the tags. Also, depending on the type of RF tag device used, some RF tags have lithium batteries which generate an electrical field for transmission. There is a possibility that data may be lost or incapable of being transmitted because of failure in the power source. Depending on the tag used, costs can range from approximately $1 to $200. Occasionally, tags get damaged or lost (AFMC, 1995: 17).

AIT offers the possibility to greatly enhance the DoD's ITV system. These technologies can be used to update various computer systems that feed the GTN system. Since AIT is automatic, errors associated with data input and human resource requirements would be minimized.

Standardization and Data Requirements

Implications associated with consolidating many existing transportation publications into one comprehensive Defense Transportation Regulation (DTR) would solve a long-standing deficiency. DTR would provide a framework that focuses on standardizing transportation operations for the movement of passengers, freight, personal property, and units from origin to destination. This standardization would streamline, simplify, and update a system by reducing fragmentation and confusion within the DoD transportation system. DTR provides a better tool for those who make transportation decisions (DoD, 1994: 1).

Documentation. The implications of adopting documentation standardization throughout the military services as well as within the commercial industry provide an avenue for discipline. The most sophisticated AIT devices are often loaded at one location then interrogated at a different location (Ross, 1996). Therefore, accountability for quality of data must be established throughout the shipping and transporting community.

Adopting a concept such as I2P, offers the "biggest bang for the buck" (Wakeley, 1996). This concept is a relatively simple negotiation of a single standard shipment identifier throughout all of DoD and the participating commercial air express carriers. Confusion caused by data transactions were reduced by simply negotiating a standard placement of bar coded data elements, structured with ANSI conventions, on all shipping labels.

Human Interface. Standardization will not only reduce problems associated with policy and procedures, it will also reduce the problems associated with human interface. People are involved in every step of the DoD transportation process. Often, human interface becomes the weak link within the process. Successful and effective use of computer technology begins with the initial introduction of data elements. Standardizing the process of how data is inserted in this system ultimately reduces the chance of duplication or error (Bunn, 1996).

Standardization affords people the opportunity to become comfortable and more familiar with hardware and/or software requirements. For example, a simple drop-down menu can alleviate the problem of documentation error when trying to decide how to input an aircraft type. Is it inserted into the system as C-5, C5, C/5, etc.? A drop down menu will allow the terminal operator the ability to point and click on the correct aircraft identifier (Bunn, 1996).

Once again, the accuracy of the detail is essential, and the time required to manually enter the data is prohibitive. Standardization will work to benefit the efficiency of the DoD and commercial transportation community.

Summary

The information age brought with it extraordinary capabilities. First, USTRANSCOM made considerable progress in laying the foundation GTN system which offer a common system with broad functional coverage. Implications for GTN's use offers a variety of benefits to its customers. By tapping into several independent data sources, GTN will eliminate uncertainties within our transportation pipeline. Second, system migration will promote the effective use of GTN and eliminate system redundancy and conflict. Through system migration, users of GTN will be able to selectively request and retrieve data as needed. Third, tender submissions; planning processes; movement processes; and payment processes collectively benefit from EDI. EDI offers added value in its ability to transfer accurate and timely information. Fourth, AIT offers the opportunity to reduce the number of human-machine interactions. Linear bar coding, two-dimensional bar coding, and RFID are just a few AIT initiatives which offer great rewards to its users. Finally, accountability for quality of data can be established throughout the shipping and transporting community by implementing several standardization procedures. Without standardization, technology cannot be effectively utilized.

VI. Recommendations and Conclusions

Overview

Since 1989, AMC operations have remained high while overall the military continues to downsize. Fewer personnel, obsolete infrastructure, and aging equipment have strained AMC's ability to do its mission and emphasized the need for continued modernization. Just like its commercial transportation counterparts, the DTS must be able to use commercial applications to enhance AMC's responsiveness and abilities to support operations in austere environments (AMMP, 1996: 4-33).

In this chapter, the investigative questions introduced in Chapter I will be addressed. The answers presented will be formulated by information presented throughout this research paper.

Investigative Questions

Question 1. *The DoD has several requirements for an ITV system. USTRANSCOM has made considerable progress in laying the foundation, through GTN, for a DoD-wide ITV capability. What are some key developments that contribute to a responsive GTN system?*

Information is the key to success. In 1995, USTRANSCOM moved 266,000 short tons of cargo, and 440,000 passengers through the airlift system. Surface movement encompassed 10.7 million metric tons, 177,000 containers and 642,000 individual household goods shipments. Half of our lift transportation capability is found in the commercial sector, 88% of the land, and more than 50% on the sea. DoD transportation is big business (Turpin, 1995: 34). In a speech given to the Information and Emerging Technologies Panel III, Major General William Begert discussed in-transit visibility issues concerning 1995 operations: Uphold Democracy, Sea Signal, Safe Passage, Safe Haven, and the UN forces in Haiti. "If you think that we (USTRANSCOM) knew and had in-transit visibility of all that cargo that was on those airplanes, you're wrong." explained Major General Begert. USTRANSCOM depends on technology to fill the ITV voids. Major General Begert went on to say "we must have systems like GTN and the emerging technologies to help us do it right" (Begert, 1995).

In the past, military transportation has been managed by single managers for air, sea, and land within their respective Services. Automated systems were developed individually to meet specific customer requirements. This approach resulted in minimal horizontal system integration. What USTRANSCOM delivers to the table is integration and synchronization of all those forces--air, land, and sea. Through system integration and synchronization, USTRANSCOM is reducing the number of DoD information systems from 137 down to approximately 23. The different services and agencies have to bend, compromise, and work together in order to improve the efficiency of the DoD transportation system (Turpin, 1995, 35).

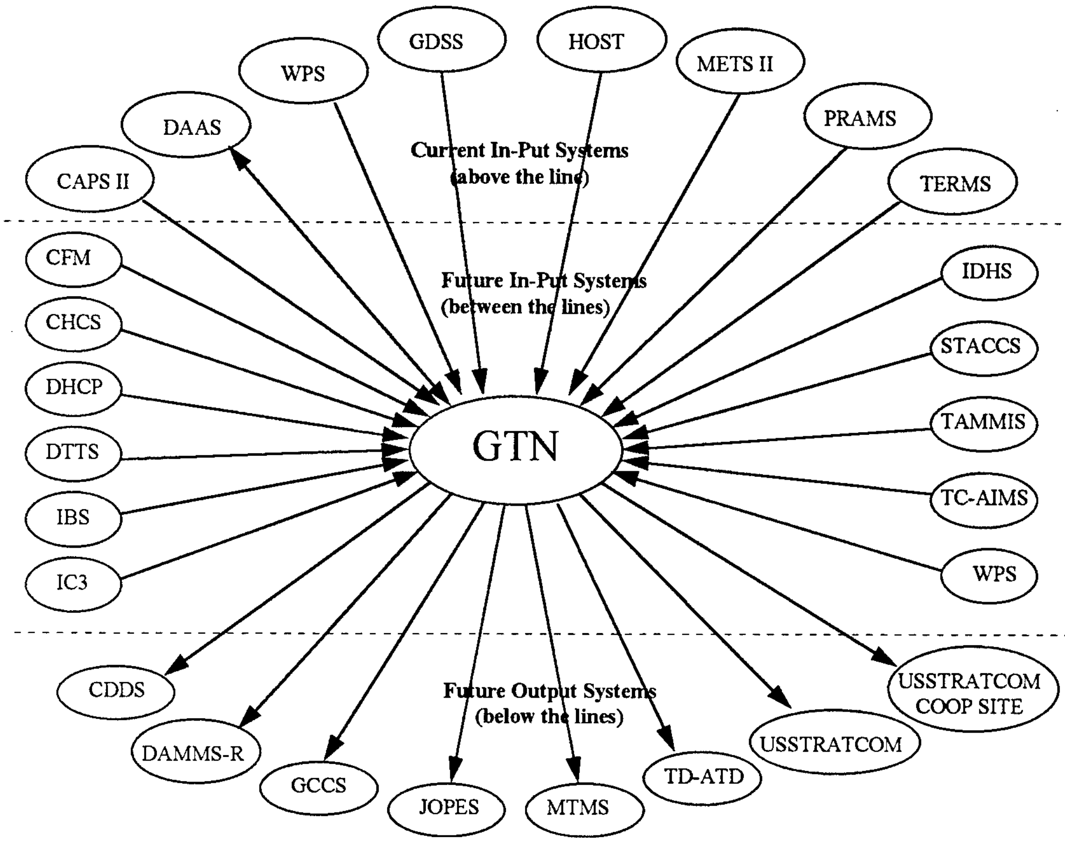

Figure 9. Future GTN Interfaces (DISA, 1995b: 21)

USTRANSCOM's GTN vision is to gather a family of transportation customers and providers of transportation into a single integrated network that will provide in-transit visibility and the command and control systems necessary to support their needs. Figure 9 displays the current input systems, future input systems, and future output systems that will enable GTN to meet this vision.

Joint Vision 2010 emphasizes USTRANSCOM's attempts to meet the needs of their ultimate customer, the theater CINC. First, transportation processes and products must be versatile so that they can be effectively used in both the military environment as well as the commercial environment. Proven component interoperability is essential. Second, the transportation system must be standards based. Unique proprietary solutions are expensive to change. Finally, technology will continue to expand DoD's capability to track and monitor cargo, GTN must be capable of flexibility and future growth (Barton, 1995: 35).

Integrated ITV over the DTS provided by the GTN represents a new and fascinating capability for USTRANSCOM's customers. Once the final version of GTN comes on-line, it will significantly enhance the ITV capabilities presently available in GTN version 2.3 by incorporating more DoD source systems and integrating some commercial transportation systems. This enhanced ITV capability should greatly increase the value and benefit of the GTN to DTS customers requiring transportation information. (Barton, 1995: 35).

As GTN expands it horizons, further research should be conducted on the full version of GTN. This research should concentrate on the logistical cost benefits and strategic changes possible from its enhanced ITV capability.

Question 2. *In the past, poor data quality and the absence of timely data, each contributed adversely to an inadequate ITV system. Effective ITV is possible only if the defense and commercial systems that feed GTN provide timely and complete data with a high degree of accuracy. How can the DoD increase its efficiency of its transportation system using electronic technology?*

In addition to enhancing cargo tracking capabilities, quick and accurate entry of data into a central data base is essential. Manual data entry is labor intensive, time consuming, and prone to errors. Therefore, current technologies, such as EDI, are evolving which continue to move the DoD and commercial transportation communities from manual data entry toward electronic transactions.

EDI has been described as the interchange of structured data according to agreed message standards between computer systems, by electronic means. As the powers of computing and telecommunications have grown, EDI technologies have evolved as a natural data carrier replacing the paper document. Drastically reduced costs of computing hardware, software, and telecommunications combined with the lifting trade barriers across Europe mean that EDI is moving from an embryonic, innovative phase into a phase of exponential growth (Kazzaz, 1996: 28). The DoD has seen EDI as much more than a way of automating tedious manual paperladen processes. They envision EDI as a tool which allows business processes to be executed using more effective but totally different approaches (Wakeley, 1996).

Initial EDI applications concentrated on efficiency by improving data flow and error reduction. Today, the DoD is expanding on this capability. EDI systems are being used to shorten the lead time between tender submission and payment transportation processes. Through EDI, the DoD is experimenting with transmitting invoice data and payment procedures which ultimately improve, both DoD and commercial, cash flow. In many cases this increase the amount of working capital as accounts can be dealt with more efficiently. Carriers and banks are supporting the DoD's use of EDI in the area of EFT.

This technology not only reduces the amount of paperwork required to complete the payment process, it also affords the carrier the opportunity to be paid sooner (Wakeley, 1996).

Trade information obtained from historical data built up from EDI transactions proves to be an invaluable source of transportation research and strategic planing information. This can best be seen in MTMC's use of EDI within CFM. Within CFM, EDI provides support to DoD transportation processing and planning through interfaces with defense transportation and commercial transportation systems. Through the use of EDI techniques, it exchanges shipment information with users from transportation offices, carriers, and DFAS-IN (Wakeley, 1996).

The process of the DoD working with trading partners to implement EDI can also result in the benefits of a closer working relationship between trading partners. Not to mention, effective use of DoD EDI procedures provides better levels of customer satisfaction and improved marketing competitiveness (McVeigh, 1996).

EDI is implemented in the same way as any other major business strategy, that is to say in a piecemeal fashion. The DoD needs to continue to evaluate each stage of implementation before moving on to the next. They also have to realize the implications associated with changing an entire process. These implications can be felt not only within the DoD, they can also be felt within the commercial transportation community. Change does not come without a price. To prevent any disruption, it is advisable to recommend not to attempt to switch to full EDI operations overnight. It takes time for people, systems, and processes to adapt to the new technology (Wakeley, 1996).

Once full implementation of EDI is ready to be considered, agreements on specific responsibilities and standards need to be addressed. Some of these issues will be discussed in investigative question 4.

Question 3. *Even after GTN is developed and the required system interfaces are in place, the risk of inadequate communications capacities in many potential theaters throughout the world will still be high. What are some of the technologies the DoD is exploring to augment its current data collection efforts?*

In order to speed the input of essential data and increase the accuracy over manual inputs, the DoD is using bar coding and/or radio frequency tags to help feed information to GTN. Linear bar coding is the cornerstone in the DoD, as well as the commercial sector, in their efforts to improve inventory management. The ultimate goal of bar coding is to provide accurate information about inventory as it moves through the transportation pipeline (Ross, 1996).

As bar coding increased in usage, it became apparent to the DoD and commercial transportation community industry standards must be developed. HQ USAF/LG has worked closely with Emery Worldwide, UPS, and Federal Express in the development and application of I2P. Within the I2P process, standard labels can be manufactured by any of the participating members. This allows for standardization, effective and efficient use of bar codes, while allowing for proprietary information in selected areas on the label. This is a tremendous break through for the relationship between the DoD and the commercial transportation industry. The DoD and leading commercial transportation giants are attempting to set standards which provide for effective use of technology (Wakeley, 1996).

It will be wise for the DoD to continue its step-by-step application and evaluation of bar codes. AIT technology is growing faster than data devices can be implemented, but it is painfully obvious that AIT is needed in today's quest for information. Each piece of AIT equipment has its own set of limitations. It will be up to the DoD, in cooperation with the commercial sector, to lead the way in the application of AIT equipment (Ross, 1996).

Just as Emery Worldwide and UPS, the DoD is beginning to get the right inventory to the right places at the right time by reducing picking and shipping errors. Lessons learned from the commercial transportation community will help quantify benefits in a variety of industry and DoD applications. The commercial sector, over the next five to ten years, plans to spend billions of dollars toward developing and strengthening their electronic links with their customers. With today's focus on benchmarking, it only seems wise for the DoD to work hand-in-hand with the commercial transportation community toward building a strategic bond (Jones, 1996).

Currently, the Army, Air Force, DLA, Marine Corps, and Navy each have an office designated to studying the benefits and disadvantages of using various AIT devices. It is of vital importance that these agencies continue to work together and create component interoperability and standards between not only the military services, but the commercial transportation community as well (Bunn, 1996).

Question 4. *Implications associated with transportation standards and fragmented regulations within the DoD transportation system are being addressed. What are some of the initiatives USTRANSCOM is taking to overcome these implications?*

USTRANSCOM's review of past transportation publications led them to initiate a change. Existing regulations and policies were fragmented and often confusing. There was a need to streamline, simplify, and update transportation and traffic management publications. The DoD needed a better tool for those who make transportation decisions. This change gave birth to the development of the Defense Transportation Regulation (DTR) (DoD, 1994: 1).

The DTR establishes common procedures for the movement of passengers, freight, personal property, and units from origin to destination (Rutherford, 1995: 10). In order to provide a more user friendly regulation, USTRANSCOM has elected to divide the DTR into four major areas: Passenger, Cargo, Mobility, and Personal Property. Not only will each volume explain how to use the DTR, it will also show how to propose policy and procedural changes. USTRANSCOM and the Defense Logistic Management Standards Office are working in consort to ensure the pertinent portions of MILSTAMP may be included in the DTR for functional use. As this regulation becomes widely used by all services, it will undoubtedly work to standardize many transportation procedures. DTR needs to be continued to be developed and promulgated in support of all logistics users and should be the controlling language of the DoD transportation community (DoD, 1994: 2).

Today, most of the world's EDI users are in the United States, and ANSI X12 is the most widely used standard in the world. European countries are becoming big players in international trade. The 12 members of the European Economic Community (EEC) account for 39% of the world's trade and have taken an interest in EDIFACT. Despite the fact that EDIFACT is a minority standard in the United States, there is efforts underway to align X12 standards to EDIFACT standards (Payne, 1991: 23).. The long term goal of the DoD must be to implement EDI applications that will be integrated regionally as well as internationally. The EDI user community will eventually tire of supporting multiple standards, demanding a single system that can be used with all trading partners. Procedural alignment must be made before full integration of EDI capabilities can take place.

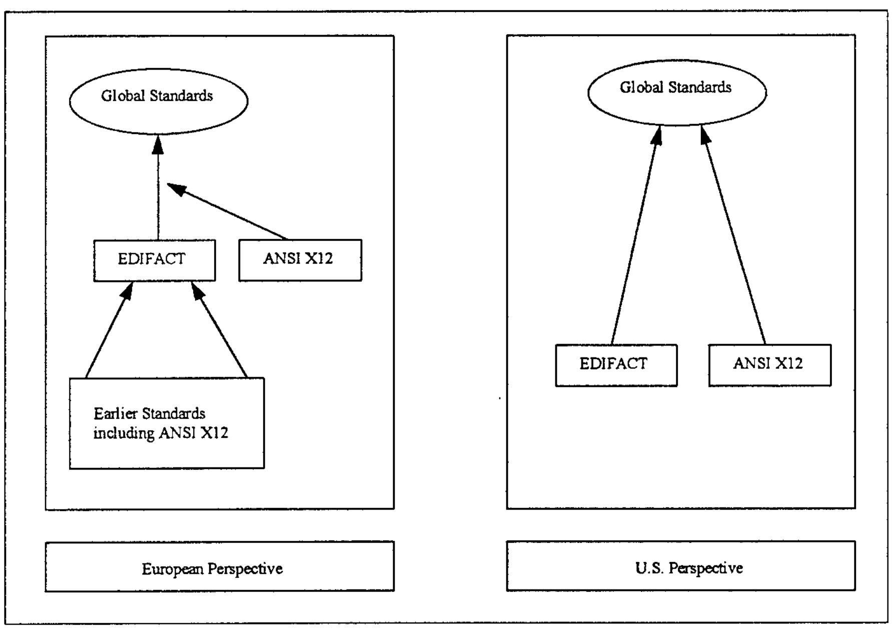

Figure 10. U.S. vs. European Perspective on Standards Convergence (Payne, 1991: 25)

The jury is still out as to which standard will achieve its vision. Alignment will mean changing both ASC X12 procedures and the standards themselves. Figure 10 displays the current views concerning EDI standards. The European perspective encompasses previous ANSI X12 standards and incorporates them into EDIFACT. It also allows for the merging of new ANSI X12 standards. Conversely, the U.S. perspective illustrates how the two systems are seen as two independent standards working on a global basis. The DoD transportation community's work is critical to determining the future relationship of X12 and EDIFACT standards. Despite the different perspectives, some work is progressing on aligning the standards and the standards process (Payne, 1991: 25).

Another standardization issue that must be addressed by the DoD is human interface standardization procedures. Frequently, when a military computer system is developed and implemented, the emphasis in training is on the transaction processing and data entering function. If there is any training for supervisors, it is usually similar to the system operator's. What seems to be lacking is understanding of the relative importance of each systems operator's keystroke. The AMC goal of attaining less than 2% operator error rate cannot be achieved until the DoD emphasizes the value of attention to detail and standardization at the lowest level possible. AMC is making an attempt to highlight input deficiencies each month. HQ AMC/DOU prepares a monthly metric which is sent out to AMC units urging those who are above 20% to evaluate and make necessary changes to their system. Transportation managers must stress the quality theme that "ITV data is only as good as what information is entered into the computer" (Baer, 1996).

Research Paper Summary

GTN will eventually achieve ITV capability by capturing information about cargo and passengers. EDI, coupled with AIT equipment, will continue to be used to enhance the flow of information as cargo and passengers process through each node of the transportation pipeline. The migration strategy, an attempt to reduce the number of source systems feeding information into GTN, will eventually streamline and simplify GTN's data collection process. Other challenges that face the DoD transportation community are standardization concerns. Data structure, processing, and dialect need to aligned with DoD commercial trading partners. USTRANSCOM's efforts to reduce confusion and eliminate redundancy concerning transportation regulations will return huge returns on investment once DTR becomes widely used.

Based on interviews conducted and data received during this research, more emphasis needs to be placed on operator data entry procedures. The first step in creating an effective ITV system is to capture all the source data. Technology is available to process this information, but only if the DoD supplies the correct information. Without all the source data, holes will exist in the DoD's ITV system and repeat mistakes of the past will ultimately haunt the movement process.

Appendix A

System Descriptions

ADANS — AMC Deployment Analysis System (AMC). Prepares movement tables and schedules for operation plans, operations orders, channel requirements, and tanker schedules. It assists in transportation feasibility analysis.

ALM — Air Load Module (MTMC). Knowledge based expert system that assists users of the system in the complex task of loading Air Force primary organic mission aircraft. It is a module of the transportation Coordinator Automated Command and Control Information System (TCACCIS).

AMP — Analysis of Mobility Platform (USTRANSCOM). Provides the capability to rapidly analyze the transportation feasibility of a specific Timed Phased Force Deployment Data (TPFDD) against a planner defined transportation environment. Uses ELIST, JFAST, and AMS to provide capability.

AMS — Asset Management System (MTMC). Provides up-to-date information on movement of critical items. AMS is the only system that adequately manages the DoD common user intermodal container and rail fleet for high-level transportation planning and execution purposes.

C2IPS — Command and Control Information Processing System (AMC). Enables AMC organizations to exchange information between the operation, logistics, transportation, and intelligence functional areas. It will be a single, integrated computer system to aid the command and control activities in the theater.

CANTRACS — Canadian Transportation Automated Control System (DLA). Cargo routing and rating system which supports shipments originating in Canada. It maintains all Canadian commercial freight tenders and contracts. CANTRACS provides transportation personnel with a single user interface for entering shipment request data. Through a validation process, the system assures that all mandatory MILSTAMP data elements, equipment codes, and Service unique criteria are valid for the type of shipment being entered.

CAPS II	Consolidated Aerial Port Subsystem II (CAPS II). Is an AMC unclassified automated system which provides cargo and passenger movement data to HOST and PRAMS. CAPS II has three application modes which encompass aerial port command and control operations, passenger processing and manifesting, and cargo movement process. Replaces ADAM III
CFM	CONUS Freight Management System (MTMC). Provides support to DoD transportation processing and planning through interfaces with Defense transportation and commercial transportation systems. It automates shipment planning and document preparation. Through the use of EDI techniques, it exchanges shipment information with users from transportation offices, carriers, and the Defense Finance and Accounting Service (DFAS).
DAAS	Defense Automated Addressing System (DAAS) - Is the Defense Logistics Agency's unclassified system for automatically routing Military Standard Requisition and Issue Procedures (MILSTRIP) transactions among customers, suppliers, depots, and shipping activities. Currently, not all requisitions are routed through DASS.
GDSS	Global Decision Support System (GDSS) - AMC's primary C^2 system, will be the source of planned and actual itineraries, and scheduled ULN allocations for all AMC carriers and tankers. GDSS will provide GTN with real time updates as information changes. GDSS provides data concerning airlift mission schedules, actual departures and arrivals of aircraft, and summarizes information on what the aircraft (AMC or commercial) is carrying, to include OPLAN ULNs, short tons of cargo, and number of passengers being transported.
GTN	Global Transportation Network (USTRANSCOM). Provides the automated support that USTRANSCOM and its components need to carry out their global transportation management responsibilities. It provides the integrated transportation data necessary to accomplish transportation planning, command and control, patient movement, and in-transit visibility of units, passengers, and cargo during peace and war.

GOPAX	Group Operational Passenger System (MTMC). Supports MTMC procurement of surface transportation and AMC procurement of air transportation for groups of 21 of more people traveling 450 or more miles. GOPAX performs the booking process for groups of passengers and passes the booking to the requester.
HOST	Headquarters On-Line System for Transportation (HOST) - Is the AMC's unclassified system for documenting airlift cargo operations worldwide. GTN will receive information from HOST about manifested, airlift cargo in-transit, and cargo on-hand at AMC aerial ports.
IBS	Integrated Booking System (MTMC). A new traffic management system at MTMC area commands that will register cargo for sealift,provide schedules for unit arrivals at ports, and issue port calls to units. It will include the functionality of the Military Export Traffic System II (METS II) and the Automated System for Processing Unit Requirements (ASPUR).
IC3	Integrated Command, Control and Communications System (MSC) The Military Sealift Command's new command, control, and communications system that will be integrated with the Navy's Operational Support System. Both are under development.
ICODES	Integrated Computerized Deployment System (MTMC). Integrates multiple expert systems, databases, and graphical user interfaces within a computer-based, distributed, cooperative operational environment. This is a migration system to replace load planning CODES system.
ITV MOD (HOST)	In-transit Visibility Modernization (AMC). Provides the link between the service air clearance authority and the aerial ports. Together with its subsystems, it provides advanced air-eligible cargo notification, cargo status, and cargo tracking to USTRANSCOM, the services aerial ports, AMC, and MTMC. It integrates and coordinates the efforts of the aerial ports through an interchange of mission-related cargo movement information.
JALIS	Joint Air Logistics Information Support System (USN). Supports the scheduling function for Operational Support Aircraft (OSA).

JFAST	Joint Flow and Analysis System for Transportation (USTRANSCOM). Establishes an initial transportation requirement from the Timed Phased Force Deployment Data (TPFDD). Determine closure, congestion points, lift utilization, and shortfalls for strategic lift. Projects delivery profiles, required lift by day versus available, and port workloads.
JOPES	Joint Operations Planning and Execution System (JCS). The foundation of the DoD's conventional command and control system, which is comprised of policies, procedures, and reporting systems supported by automation. It is used to monitor, plan, and execute mobilization, deployment, employment and sustainment activities in peace, exercises, crisis, and war.
LOGAIS	Logistics Automated Information System (USMC). Consists of a family of Marine Corps planning, deployment, and redeployment systems that help bridge the gap between JOPES and other related systems. This is the Marine Corps TC AIMS system.
METS II	Mechanized Export Traffic System (METS II)/IBS - Is the MTMC Area Command's unclassified system for managing ocean cargo clearance authority functions for booking cargo on MSC or commercial ships. METS provides schedules for unit arrival at ports, issues port calls to he units, and also provides information concerning bookings of containerized and break bulk cargo on scheduled voyages.
MOBCON	Mobilization Control (USA NG) Provides a unique capability to facilitate passing of hard-copy requests to state and local authorities for organic convoy clearance in support of CONUS unit movements from origin to POE and POD to destination.
NAOMIS	Navy Material Transportation Office Operations and Management System (USN). Replacement system for the Navy Automated Transportation Systems (NATS) which was the Navy's Air Clearance Authority system for CONUS to Outside CONUS (OCONUS) shipments. NAOMIS receives, processes, and clears cargo offerings from Navy sponsored shippers.

PRAMS	Passenger Reservation and Manifesting System (PRAMS) - Is an AMC unclassified system for documenting airlift passenger operations for DoD. GTN will also collect planned and actual passenger reservations and manifests from PRAMS component, the Second Generation Passenger Reservation and Check-in System (SPRACS)
TC ACCIS	Transportation Coordinator's Automated Command and Control Information System (USA). The Army TC AIMS system that is used to plan and execute unit deployments and redeployments worldwide, communicate data to Forces Command for updating JOPES, and communicate to MTMC for port operations and load planning. It generates air load plans, air cargo manifests, unit movement data, convoy march tables and clearance requests, rail load plans, bills of lading, and bar code labels.
TC-AIMS	Transportation Coordinator's Automated Information for Movement System (USA/USMC/USAF). A family of systems that automates the planning, organizing, coordinating, and controlling of unit-related deployment activities supporting the overall deployment process. It permits transportation offices to maintain an automated data base of current unit movement data. TC AIMS family of systems include TC ACCIS, LOGAIS, and CMOS.
TERMS/WPS	Terminal Management System (TERMS)/WPS - Updates GTN with "cargo at port awaiting sea shipment, cargo loaded on and off ships, sailing ships, and cargo that has departed from port.
TOPS	Transportation Operational Personal Property Standard System (MTMC). Automates the processes and procedures governing the movement and storage of personal property belonging to military members and DoD civilians. It provides the processing and communications necessary for source data automation and ensures the accurate and timely exchange of information between personal property offices and finance centers.

TRAMS	Transportation Automated Management System (DLA). Processes shipment data and operates on a two-tier system architecture design. Its functions include entering and validating shipment requests, awarding shipments to carriers with reason codes for not selecting the low-cost carrier, recording service failures, creating Government Bills of Lading (GBLs) and correction notices, printing shipping documents, transmitting GBL data to host computers, creating transportation discrepancy reports, producing management reports, and applying local non-use carrier penalties.
WPS	Worldwide Port System (WPS) - Is the MTMC worldwide unclassified system for managing export and import of DoD cargo arriving, departing, and on-hand at water ports. WPS records cargo data for surface movements at MTMC area commands; receipt, staging, and load cargo at ports; and generates the ship manifest upon competition of vessel loading.

Appendix B

Acronym List

AAFES	Army/Air Force Exchange Service
ADANS	AMC Deployment Analysis System
AFDD	Air Force Doctrine Document
AFMC	Air Force Material Command
AIT	Automatic Identification Technology
ALM	Air Load Module
AMC	Air Mobility Command
AMMP	Air Mobility Master Plan
AMS	Asset Management System
ANSI	American National Standards Institute
APOD	Aerial Port of Debarkation
APOE	Aerial Port of Embarkation
ASC	American Standards Code
ASC II	American Standards Code II
ATCMD	Advanced Transportation Control and Movement Document
C^2	Command and Control
C2IPS	Command and Control Information Processing System
CANTRACS	Canadian Transportation Automated Control System
CAPS II	Consolidated Aerial Port Subsystem II
CBL	Commercial Bill of Lading
CDDS	CINC Decision Support System
CFM	CONUS Freight Management
CHCS	Composite Health Care System
CIM	Corporate Information Management
CINC	Commander-in-Chief
CMOS	Cargo Movement Operations System
CONUS	Continental United States
DAAS	Defense Automated Addressing System
DAMMS-R	Department of the Army Movements Management System - Redesigned
DASP-E	Department of Army Standard Port System - Enhanced
DBOF	Defense Business Operating Fund
DFAR	Defense Federal Acquisition Regulation
DFAS-IN	Defense Finance and Accounting Service-Indianapolis
DHCP	Defense Health Care Program
DISA	Defense Information System Agency
DLA	Defense Logistics Agency
DoD	Department of Defense

DSO	Days Sales Outstanding
DTEDI	Defense Transportation Electronic Data Interchange
DTR	Defense Transportation Regulation
DTRS	Defense Transportation Payment System
DTS	Defense Transportation System
DTTS	Defense Transportation Tracking System
DUSD(L)	Deputy Under Secretary of Defense for Logistics
EDI	Electronic Data Interchange
EDIFACT	Electronic Data Interchange for Administration, Commerce, and Transportation
EEC	European Economic Community
EFT	Electronic Funds Transfer
ELIST	Enhanced Logistics Intra-Theater Support Tool
EMCON	Emery Control
FAR	Federal Acquisition Regulation
FIPS	Federal Information Processing Board Publications
GBL	Government Bill of Lading
GCCS	Global Command and Control System
GDSS	Global Decision Support System
GDSS-MLS	Global Decision Support System - Multi-level Security
GOPAX	Group Operational Passenger System
GSA	General Services Administration
GT	Guaranteed Traffic
GTN	Global Transportation Network
HQ AMC	Headquarters Air Mobility Command
HQ USAF	Headquarters United states Air Force
HOST	Headquarters On-Line System for Transportation
I2P	Standard Transportation Industry Information Processor
IBS	Integrated Booking System
IC3	Integrated Command, Control, and Communications System
ICAO	International Civil Aviation Organization
ICODES	Integrated Computerized Deployment System
IDHS	Intelligence Data Handling System
ITO	Installation Transportation Officer
ITV	In-transit Visibility
ITV MOD	In-transit Visibility Modernization
JALIS	Joint Air Logistics Information Support System
JOPES	Joint Operations Planning and Execution System

JTCC	Joint Transportation Corporate Information Management Center
MDSS II	MAGTF Deployment Support System II
METS II	Mechanized Export Traffic System
MILSTAMP	Military Standard Transportation and Movement Procedures
MIL-STD	Military Standard
MOBCON	Mobilization Control
MSC	Military Sealift Command
MTMC	Military Traffic Management Command
MTMS	Military Transportation Management System
NAOMIS	Navy Material Transportation Office Operations and Management System
NCA	National Command Authority
NDTA	National Defense Transportation Association
NSN	National Stock Number
OSA	Operational Support Aircraft
OSD	Office of the Secretary of Defense
POD	Port of Debarkation
POE	Port of Embarkation
POMCUS	Prepositioning of Materiel Configured to Unit Sets
PPTMR	Personal Property Traffic Management Regulation
PRAMS	Passenger Reservation and Manifesting System
RF	Radio Frequency
RFID	Radio Frequency Identification
SAAM	Special Assignment Airlift Mission
STACCS	Standard Theater Army Command and Control System
TAMIS	Tanker Airlift Mobility Integration System
TAV	Total Asset Visibility
TC-AIMS	Transportation Coordinator's Automated Command and Control Information System
TC-AIMS II	Transportation Coordinator's Automated Command and Control Information System II
TCC	Transportation Component Command
TCMD	Transportation Command and Movement Document
TCN	Transportation Control Number
TD-ATD	Total Distribution - Advanced Technology Demonstration
TERMS	Terminal Management System
TMO	Traffic Management Office

TO	Transportation Officer
TOPS	Transportation Operational Personal Property Standard System
TPFDD	Time-Phased Force Deployment Data
UPC	Universal product Code
UPS	United Parcel Service
USA	United States Army
USA-NG	United States Army National Guard
USAF	United States Air Force
USN	United States Navy
USTC	United States Transportation Command
USSTRATCOM	United States Strategic Command
USTRANSCOM	United States Transportation Command
WPS	Worldwide Port System

Appendix C

Input Error Metrics. The following pages contain data for Appendix C

AMC UNIT	APRIL PERCENTAGE	APRIL REJECT	APRIL MESSAGES
141ARW	83.33%	5	6
43ARG	62.61%	72	115
911AW	57.14%	4	7
934AW	50.00%	1	2
625SS	41.05%	39	95
126ARW	32.43%	24	74
92ARW	27.58%	182	660
634SS	27.53%	98	356
633SS	27.25%	263	965
164AW	27.12%	16	59
629SS	27.10%	116	428
623SS	25.02%	698	2790
628SS	24.02%	98	408
151ARW	23.94%	17	71
108ARW	23.53%	4	17
319ARW	23.48%	143	609
128ARW	22.76%	56	246
440AW	21.57%	11	51
305AMW	21.36%	367	1718
22ARW	21.23%	283	1333
133AW	20.92%	32	153
439AW	20.72%	52	251
436AW	19.20%	320	1667
631SS	18.05%	76	421
640SS	18.02%	62	344
375AW	17.94%	370	2063
627SS	17.50%	158	903
632SS	17.28%	113	654
157ARW	17.14%	24	140
101ARW	16.76%	87	519
626SS	16.57%	57	344
155ARW	15.63%	20	128
89AW	15.52%	43	277
624AMSG	15.31%	190	1241
437AW	13.31%	299	2246
445AW	13.29%	97	730
171ARW	12.54%	41	327
105AW	11.69%	27	231
62AW	10.91%	166	1522
60AMW	10.59%	306	2889
134ARW	9.50%	32	337
459AW	8.80%	11	125
635SS	8.00%	77	962
172AW	7.69%	16	208
927ARW	5.33%	8	150
19ARW	0.00%	0	0
349AMW	0.00%	0	0
630SS	0.00%	0	0
117ARW	0.00%	0	0
121ARW	0.00%	0	0
161ARW	0.00%	0	0
186ARW	0.00%	0	0
190ARW	0.00%	0	0
AMC TOTAL	17.96%	5181	28842

PACAF UNITS	APRIL PERCENTAGE	APRIL REJECT	APRIL MESSAGES
374AW	26.60%	445	1673
3WG	26.37%	24	91
51FW	0.00%	0	0
PACAF TOTAL	26.59%	469	1764

USAFE UNITS	APRIL PERCENTAGE	APRIL REJECT	APRIL MESSAGES
100ARW	17.79%	90	506
86AW	0.00%	0	0
USAFE TOTAL	17.79%	90	506

ACC UNITS	APRIL PERCENTAGE	APRIL REJECT	APRIL MESSAGES
23WG	24.92%	155	622
24WG	0.00%	0	0
314AW	18.67%	45	241
8AF	0.00%	0	0
ACC TOTAL	23.17%	200	863

DEPLOYED UNITS	APRIL PERCENTAGE	APRIL REJECT	APRIL MESSAGES
4404WG	23.06%	113	490
615CSC	20.15%	83	412
621AMC	0.00%	0	0
615OS2	0.00%	0	0
621AMSG	0.00%	0	0
621SG2	0.00%	0	0
702OS	37.55%	656	1747
JTFOJE	0.00%	0	0
TAZAR	36.31%	57	157
JTFSWA	11.46%	11	96
DEPLOYED TOTAL	31.70%	920	2902

OTHER UNITS	APRIL PERCENTAGE	APRIL REJECT	APRIL MESSAGES
NORFOL	17.00%	76	447
7CS	0.00%	0	0
OTHER TOTALS	17.00%	76	447
NON-AMC TOTALS	27.07%	1755	6482
C2IPS TOTALS	19.64%	6936	35324

AMC UNITS	MAY PERCENTAGE	MAY REJECT	MAY MESSAGES
126ARW	63.79%	111	174
133AW	51.35%	19	37
141ARW	50.00%	3	6
934AW	50.00%	10	20
108ARW	42.86%	3	7
164AW	38.10%	16	42
629SS	32.84%	111	338
157ARW	30.32%	57	188
625SS	29.00%	58	200
22ARW	28.89%	401	1388
927ARW	28.89%	52	180
623SS	27.03%	782	2893
634SS	26.33%	109	414
633SS	23.93%	241	1007
628SS	23.81%	90	378
459AW	23.33%	14	60
305AMW	23.06%	508	2203
626SS	22.58%	70	310
911AW	22.50%	18	80
89AW	22.41%	78	348
440AW	20.45%	27	132
319ARW	19.29%	93	482
631SS	19.25%	67	348
92ARW	18.90%	103	545
172AW	18.09%	36	199
375AW	17.14%	401	2339
171ARW	16.67%	56	336
627SS	16.59%	103	621
43ARG	16.17%	54	334
436AW	14.71%	246	1672
128ARW	14.64%	35	239
640SS	14.61%	64	438
439AW	13.66%	47	344
437AW	13.36%	324	2425
101ARW	12.82%	50	390
155ARW	12.18%	19	156
151ARW	11.11%	3	27
624AMSG	11.10%	148	1333
105AW	10.34%	18	174
445AW	09.58%	39	407
635SS	08.91%	98	1100
62AW	08.08%	113	1399
60AMW	07.77%	232	2985
632SS	07.22%	39	540
134ARW	07.17%	21	293
19ARW	00.00%	0	0
630SS	00.00%	0	0
117ARW	00.00%	0	0
121ARW	00.00%	0	0
161ARW	00.00%	0	0
186ARW	00.00%	0	0
190ARW	00.00%	0	0
349AMW	00.00%	0	3
AMC TOTALS	17.56%	5187	29534

PACAF UNITS	MAY PERCENTAGE	MAY REJECT	MAY MESSAGES
374AW	26.90%	477	1773
3WG	27.75%	63	227
51FW	00.00%	0	0
PACAF TOTALS	27.00%	540	2000

USAFE UNITS	MAY PERCENTAGE	MAY REJECT	MAY MESSAGES
100ARW	23.08%	87	377
86AW	00.00%	0	0
USAFE TOTALS	23.08%	87	377

ACC UNITS	MAY PERCENTAGE	MAY REJECT	MAY MESSAGES
8AF	60.92%	53	87
314AW	52.05%	355	682
23WG	23.33%	129	553
24WG	00.00%	0	7
ACC TOTALS	40.41%	537	1329

DEPLOYE DUNITS	MAY PERCENTAGE	MAY REJECT	MAY MESSAGES
702OS	42.21%	371	879
TAZAR	36.98%	71	192
4404WG	11.49%	30	261
621AMC	00.00%	0	0
615OS2	00.00%	0	0
621AMSG	00.00%	0	0
621SG2	00.00%	0	0
JTFOJE	00.00%	0	0
615CSC	00.00%	0	2
JTFSWA	00.00%	0	60
DEPLOYE D TOTALS	33.86%	472	1394

OTHER UNITS	MAY PERCENTAGE	MAY REJECT	MAY MESSAGES
NORFOL	20.83%	90	432
7CS	00.00%	0	0
OTHER TOTALS	20.83%	90	432

C2IPS TOTALS	19.71%	6913	35066

AMC UNITS	JUNE PERCENTAGE	JUNE REJECTS	JUNE MESSAGES
927ARW	65.85%	81	123
141ARW	60.00%	3	5
133AW	59.46%	22	37
164AW	50.00%	19	38
934AW	40.00%	2	5
126ARW	38.92%	65	167
305AMW	28.13%	501	1781
625SS	27.40%	77	281
633SS	27.38%	184	672
629SS	26.49%	98	370
319ARW	23.87%	111	465
623SS	22.13%	455	2056
151ARW	21.05%	8	38
157ARW	20.81%	46	221
121ARW	20.45%	9	44
634SS	20.41%	70	343
92ARW	20.06%	141	703
89AW	19.72%	86	436
440AW	19.13%	22	115
459AW	18.18%	14	77
628SS	17.75%	68	383
632SS	17.37%	95	547
627SS	17.13%	110	642
128ARW	16.49%	31	188
43ARG	16.11%	24	149
640SS	14.53%	52	358
624AMSG	13.83%	165	1193
171ARW	13.54%	31	229
22ARW	13.43%	114	849
436AW	13.24%	228	1722
911AW	12.82%	10	78
375AW	12.44%	278	2234
631SS	12.33%	36	292
630SS	11.76%	24	204
101ARW	11.45%	53	463
62AW	10.53%	129	1225
437AW	10.49%	191	1821
439AW	10.34%	33	319
172AW	10.24%	17	166
635SS	10.03%	76	758
60AMW	9.81%	308	3140
155ARW	9.42%	13	138
445AW	9.40%	36	383
105AW	7.41%	18	243
626SS	7.39%	21	284
134ARW	6.76%	19	281
117ARW	0.00%	0	0
161ARW	0.00%	0	0
186ARW	0.00%	0	0
349AMW	0.00%	0	1
19ARW	0.00%	0	5
108ARW	0.00%	0	11
190ARW	0.00%	0	14
AMC TOTALS	15.95%	4194	26297

PACAF UNITS	JUNE PERCENTAGE	JUNE REJECTS	JUNE MESSAGES
51FW	76.00%	19	25
3WG	39.02%	144	369
374AW	35.87%	500	1394
PACAF TOTALS	37.08%	663	1788

USAFE UNITS	JUNE PERCENTAGE	JUNE REJECTS	JUNE MESSAGES
100ARW	24.70%	104	421
86AW	0.00%	0	0
USAFE TOTALS	24.70%	104	421

ACC UNITS	JUNE PERCENTAGE	JUNE REJECTS	JUNE MESSAGES
314AW	19.58%	56	286
23WG	16.98%	54	318
8AF	0.00%	0	0
24WG	0.00%	0	2
ACC TOTALS	18.15%	110	606

DEPLOYED UNITS	JUNE PERCENTAGE	JUNE REJECTS	JUNE MESSAGES
TAZAR	47.28%	113	239
621SG2	25.66%	88	343
615OS2	25.59%	119	465
JTFOJE	17.92%	50	279
702OS	17.46%	11	63
4404WG	15.72%	122	776
621AMSG	3.70%	5	135
JTFSWA	3.43%	7	204
621AMC	0.00%	0	0
615CSC	0.00%	0	1
DEPLOYED TOTALS	20.56%	515	2505

OTHER UNITS	JUNE PERCENTAGE	JUNE REJECTS	JUNE MESSAGES
NORFOL	24.69%	100	405
7CS	0.00%	0	0
OTHER TOTALS	24.69%	100	405

C2IPS TOTALS	17.76%	5686	32022

Bibliography

Adkins, Tony. "How Bar Coding Benefits Users," The Office, 116: 38 (August 1992).

Air Force Material Command (AFMC). *Automatic Identification Technology (AIT): Market Study*. Wright-Patterson AFB OH: AFMC-LSO/LOA, May 1995.

Akard, Bruce. "Tracking the Future with Ranger," Transportation Corps, 55: 30-32 (October 1993).

Baer, Ronald E. HQ AMC/DOU, Scott AFB IL. Telephone interview. 19 Sep 1996.

Barton, Doug. "Proceedings of the 50th Annual NDTA Transportation and Logistics Forum and Exposition: Information and Emerging Technologies," EDI World: 35 (December 1995).

Begert, William. "Proceedings of the 50th Annual NDTA Transportation and Logistics Forum and Exposition: Information and Emerging Technologies," EDI World: 34 (December 1995).

Bossert, Philip A. *Strategic Airlift Inefficiencies from Desert Shield to Vigilant Warrior*. MS thesis, U.S. Army Command and General Staff College, Fort Levenworth KS, 1995 (19950927-127).

Boynton, Sharon. "The Quest for In-Transit Visibility," Presentation to the Advanced Studies of Air Mobility Students, USTRANSCOM/TCJ4-LFT, 26 Jun 1996.

Bunn, Stephen. HQ AMC/DOU, Scott AFB IL. Personal interview. 12 Sep 1996.

Coleman, Lisa. "Overnight Isn't Fast Enough," Brandweek: 26-27 (July 1995).

D'Angelo, Anthony P. Class handout, AMGT 602, Federal Financial Management. Department of Graduate Acquisition Management, Air Force Institute of Technology, Wright-Patterson AFB OH, 29 Sep 1995.

Defense Information Systems Agency (DISA). *Integration Decision Paper for the Global Transportation Network (GTN)*. Falls Church VA: 1 February 1995a.

-----. *Integration Decision Paper for the Joint Transportation Corporate Information Management (CIM) Center's (JTCC) Transportation Migration Systems Recommendations*. Falls Church VA: 1 February 1995b.

Department of the Air Force. *Air Force Doctrine Document (AFDD) 40: Logistics*. Washington: HQ USAF, July 1995.

-----. *Air Mobility Master Plan (AMMP)*. Washington: Government Printing Office, 1996.

Department of Defense (DoD). *Defense In-transit Visibility Integration Plan.* Washington: Government Printing Office, February, 1995a.

-----. *Defense Transportation EDI Program Implementation Plan.* Washington: Government Printing Office, June, 1996a.

-----. *Defense Transportation Regulation (DTR) Action Plan.* Washington: Government Printing Office, August 1994.

-----. *Electronic Commerce (EC)/Electronic Data Interchange (EDI) in Contract Reporting.* www.acq.osd.mil/ec/execsum.html. 9 April 1996b.

Fogleman, Ronald R., Commander-in-Chief, United States Transportation Command and Air Mobility Command. "National Security and the Defense Transportation System 2010: Hot Spots and Military Responses." Speech presented to St. Louis, Missouri Foreign Relations Committee. HQ AMC, Scott AFB MO, 2 May 1994a.

-----. As quoted by Waltz, Kim. "The United States Transportation Command," The Navy Corps Newsletter 3: 2-4 (March/April 1994b).

Gross, Gary A. *Tracking Air Force Pallets Using RFID Technology: A Concept Study.* MS thesis AFIT/GLM/LAL/95S-6. School of Logistics and Acquisition Management, Air Force Institute of Technology (AFIT), Wright-Patterson AFB OH, September 1995 (ADA-300845).

Jones, Robert. Senior Global Account Executive, United Parcel Service (UPS), Atlanta GA. Telephone interview. 15 September 1996.

Kazzaz, Daniel I. "EDI & Server-Server Technologies," EDI World: 26-30 (February 1996).

Lund, John A., Ruth Berg, and Corinne Replogle. *An Assessment of Strategic Airlift Operational Efficiency: Analysis of the Air War in the Gulf.* Santa Monica CA: Rand, 1993.

Maglitta, Joseph. "United Parcel Service: The Global 100," Computerworld: 15 (May 1995).

Manaco, Thomas. "A Training With Industry Perspective," Army Logistician, 1: 30-31 (January-February 1995).

Mathews, James K. and Cora J. Holt. "So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm," Research Center: United States Transportation Command, Scott AFB IL and Joint History Office: Office of the Chairman of the Joint Chiefs of Staff, Draft. November 1995.

McHugh, Mary Lou, Assistant Deputy Undersecretary of Defense for Logistics, Transportation Policy. "ITV: From Vision to Reality." Address to National Defense Transportation Association's Transportation Technology Committee. St. Louis MO 2 October 1994.

McVeigh, Michael. Senior Global Account Executive, Emery Worldwide, Washington DC. Personal interview. 8 September 1996.

National Defense Transportation Association (NDTA). *In-transit Visibility: Workshop.* Massachusetts: National Transportation Systems Center, 20 September 1994.

Owenby, Sallie. "Defense Transportation Regulation (DTR)," Presentation to the Advanced Studies of Air Mobility Students, USTRANSCOM/TCJ4 Transportation Management Division, 26 June 1996.

Payne, Judith E. *The Importance of DoD International Standards for Electronic Commerce.* Santa Monica CA. Rand, 1991.

Payne, Judith E. and Robert H. Anderson. *Using Electronic Commerce to Enhance Defense Logistics.* Santa Monica CA: Rand, 1991.

Ross, Robert. USTRANSCOM/TCJ4-LFT, Scott AFB IL. Personal interview. 26 Jun 1996.

Shultz, John D. "Yellow's Logistics Arm Aims for Edge by Tying Warehouse Into PC Network," Traffic World, 234: 51 (19 April 1993).

Swatman, John B. "A Road Map to EDI," Electronic Commerce World Institute: 1-8 (November 1995).

Total Asset Visibility (TAV) Conference. Sponsored by the Deputy Under Secretary of Defense (Logistics), The Pentagon, March 9-10, 1994.

Turpin, James. "Proceedings of the 50th Annual NDTA Transportation and Logistics Forum and Exposition: Information and Emerging Technologies," EDI World:. 12-35 (December 1995).

Udo, Godwin J. "The Impact of Telecommunications on Inventory Management," *Production and Inventory Management Journal, 34*: 32-37 (Second Quarter, 1993).

USTRANSCOM. *Global Transportation Network (GTN) Life Cycle Cost/Benefit Analysis.* January 1995a.

-----. *Global Transportation Network (GTN) Operational Requirements Document (ORD).* April 1993a.

-----. *Global Transportation Network (GTN) Operational Requirements Document (ORD).* January, 1995b.

-----. *Global Transportation Network (GTN) System/Segment Specification.* 15 July 1993b.

Wakeley, James. HQ USAF/LG, Washington DC. Personal interview. 29 Aug 1996.

Whitaker, George. Joint Transportation Corporate Information Management (CIM) Center (JTCC), USTRANSCOM, Scott AFB IL. Personal Interview. 21 February 1996.

Vita

Capt Dean a Wolford was born on 29 April 1962, in Goldsboro, North Carolina. He graduated from Eastern Wayne High School in 1980, and entered undergraduate studies at East Carolina University (ECU), Greenville NC. He graduated with a Bachelors of Science degree in Business Administration in 1984.

He was an ECU ROTC distinguished graduate and received his regular commission on 18 June 1985. After completing Undergraduate Pilot Training at Williams AFB, his first assignment was flying KC-135A air refueling aircraft at Barksdale AFB, Louisiana. In December 1989, Capt Wolford was selected to crossflow into the KC-10A also stationed at Barksdale AFB, Louisiana. While at Barksdale AFB, he flew many missions in support of Operation Just Cause, Desert Shield, Desert Storm and Provide Comfort gaining invaluable experience in crisis response. His next assignment took him back to Seymour Johnson AFB, NC where he served as chief scheduling pilot, chief evaluator pilot, and flight commander for the 911 AREFS. While at Seymour Johnson AFB, he earned a Master of Science degree in Aeronautical Sciences from Emery-Riddle University. In July 1994, he was selected as a member of the KC-10 ADVON Team in charge of the relocation efforts aimed at moving KC-10 assets to McGuire AFB, NJ. Once the relocation process was completed, his instructor/evaluator experience earned him a position as a KC-10 CCTS flight instructor. In July 1995, he was chosen to enter the School of Logistics and Acquisition Management, Air Force Institute of Technology as part of the Advanced Study of Air Mobility (ASAM) program.

Permanent Address: 107 Trappers Run Drive
Goldsboro, NC 27530

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE
November 1996

3. REPORT TYPE AND DATES COVERED
Graduate Research Paper

4. TITLE AND SUBTITLE
IMPROVED VISIBILITY WITHIN THE AIR FORCE ITV SYSTEM

5. FUNDING NUMBERS

6. AUTHOR(S)
Dean A. Wolford, Captain, USAF

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
2750 P Street
WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GMO/LAL/96N-15

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
HQ AMWC/WCOA
Ft Dix NJ 08640

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (*Maximum 200 Words*)

Computers, information systems, and communication systems are being used in transportation, warehousing, order processing, materials management, and procurement. In every major US deployment, lack of visibility over units and shipments entering a theater of operation has limited the military's ability to effectively conduct operational plans. Current Department of Defense (DoD) initiatives provide some level of in-transit visibility (ITV), but are we effectively using quality tools to benchmark the successes within the commercial carrier industry? The purpose of this study is to address the ITV issues and concerns existing in the military and civil intermodal shippers. Projected benefits from this study will highlight the operating ideas that are needed to support a standardized DoD communications network system that works in harmony with its civilian counterpart.

14. SUBJECT TERMS
Air Cargo, Transportation, Total Asset Visbility (TAV), In-Transit Visibility (ITV), Electronic Data Interchange (EDI), Automatic Identification Technology (AIT), Defense Transportation regulation (DTR), Bar Coding,

15. NUMBER OF PAGES
106

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

AFIT Control Number AFIT/GMO/LAL/96N-15

AFIT RESEARCH ASSESSMENT

The purpose of this questionnaire is to determine the potential for current and future applications of AFIT research. **Please return completed questionnaire** to: AFIT/LAC BLDG 641, 2950 P STREET, WRIGHT-PATTERSON AFB OH 45433-7765 or e-mail to dvaughan@afit.af.mil or nwiviott@afit.af.mil. Your response is **important.** Thank you.

1. Did this research contribute to a current research project? a. Yes b. No

2. Do you believe this research topic is significant enough that it would have been researched (or contracted) by your organization or another agency if AFIT had not researched it?
a. Yes b. No

3. **Please estimate** what this research would have cost in terms of manpower and dollars if it had been accomplished under contract or if it had been done in-house.

Man Years__________ $__________

4. Whether or not you were able to establish an equivalent value for this research (in Question 3), what is your estimate of its significance?

a. Highly Significant b. Significant c. Slightly Significant d. Of No Significance

5. Comments (Please feel free to use a separate sheet for more detailed answers and include it with this form):

Name and Grade

Organization

Position or Title

Address